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COURSE OF STUDY

AND

MANUAL OF INSTRUCTION

FOR

PRIMARY AND GRAMMAR GRADES.

HOBOKEN, N. J.

To take Effect September 1st, 1899.

PREPARED BY

A. J. DEMAREST, City Superintendent.

Adopted by the Commission of Public Instruction,
March 20th, 1899.

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Names, Residences and Terms of Office

OF THE

Commissioners of Public Instruction

OF THE

CITY OF HOBOKEN, N. J.

	TERM EXPIRES.
GEORGE H. BELL, 1207 Bloomfield Street,	1900
C. H. CARLING, 937 Bloomfield Street,	1899
T. J. DOOLEY, 609 Willow Avenue,	1900
CHAS. A. HICKS, 807 Bloomfield Street,	1899
FRANK J LEES, 514 Clinton Street,	1899
EDWARD RUSS, Second National Bank Building,	1900
HERMAN VOLL, 311 Hudson Street,	1899
PHILLIP WALDHEIM, 840 Garden Street,	1900

LAWRENCE FAGAN, MAYOR, 1000 Hudson Street, (*ex-officio.*)

OFFICERS:

PRESIDENT,

EDWARD RUSS, - Second National Bank Building.

CITY SUPERINTENDENT OF SCHOOLS,

A. J. DEMAREST, - - - 1017 Bloomfield Street.

SECRETARY OF THE COMMISSION,

WM. A. KERR, - - - - 1103 Garden Street.

TREASURER OF THE COMMISSION,

DAVID E. RUE, - - - - 1006 Park Avenue.

The Commissioners meet on the third Monday of each month
at School No. 4, on Park Avenue, near Sixth Street,
Hoboken, N. J.

Names, Residences, Terms of Office and Reorganization

OF THE

Commissioners of Public Instruction

OF THE

CITY OF HOBOKEN, N. J.

	TERM EXPIRES.
GEORGE H. BELL, 1207 Bloomfield Street,	1900
T. J. DOOLEY, 609 Willow Avenue,	1900
JOHN KERESEY, 616 Hudson Street,	1901
ERNEST MUZZI, 86 Jefferson Street,	1901
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WM. S. STUHR, 912 Hudson Street,	1900
HERMAN VOLL, 311 Hudson Street,	1901
PHILLIP WALDHEIM, 840 Garden Street,	1900

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DAVID E. RUE.

CITY SUPERINTENDENT,
A. J. DEMAREST.

COURSE OF STUDY

AND

MANUAL OF INSTRUCTION.

In accordance with the provisions of this Course of Study, the school system shall be divided into three departments, which shall be known as the primary, grammar and high departments.

The primary department shall consist of the first, second, third, fourth, and fifth grades; the grammar department shall include the sixth, seventh, eighth and ninth grades; the high department shall have three courses of study, the academic course covering four years, the commercial course covering two years, and the training course one year.

As provided in the following Course of Study, there shall be semi-annual promotions in all primary and grammar grades, on the first school day in February and during the last week in June, for all meritorious pupils.

The standing of all pupils in the ninth grammar grade and in all classes in the High School, shall be determined by written monthly tests. These tests shall be based upon the work covered during the month. An average of these monthly tests shall be the standing for the term. If the class teacher or pupil thinks the percentage obtained in the test is not a fair mark for the month's work, the same may be referred by either teacher or pupil to the principal, who, after an oral test, shall give such mark for the work as he may deem just. The City Superintendent shall be the final court of appeal.

The Course of Study for German, Drawing, and Manual Training shall not at any time encroach on the time assigned to the other studies provided for, but, on the contrary, such other studies may supplant the aforesaid mentioned studies, whenever the Committee on School Government may direct subject to the disapproval of the Commission.

The Academic Course of the High School shall cover a period of four years after the first day of September, 1899, and all teachers thereto assigned shall teach such studies and perform such duties as the Committee on School Government may from time to time determine, subject to the disapproval of the Commission.

This Course of Study shall take effect September 1st, 1899, and any portion of the Manual inconsistent with the above named rules and regulations are hereby annulled.

GEOGRAPHY.

Geography is the study of the Earth as the home of man. The human element should be made most prominent in the teaching of Geography. The history of nature has given us the physical elements of difference. It has given us a variety in climate, soil, productions; the varieties of configuration of the land and of the water. Man has come upon the scene to avail himself of the food, clothing and shelter furnished by nature. This course aims to outline the subject in such a manner as to make man the center from which everything is viewed. The manner of life, the occupations of mankind and that portion of history which shows the influence of geographical conditions on human progress, have been accorded unusual space. In accordance with modern thought, considerable attention is devoted to relief so far as it influences climate and products and the comfort and the opportunities of man. Climate is an element of our surroundings on which we are more dependent than on relief or drainage, and so it has been made more prominent. Special attention has been given to the United States and to Europe. The United States, the Great Powers of Europe, China and Japan are the three great centers of human interest at present and of hope or fear for the future. The remaining parts of the world are commercial dependencies of these three great centers.

Geography no longer means the memorizing of localities. It is a logical study and appeals to the reason, imagination and perceptive powers of the student as well as to the memory. Objective methods should be used. The lecture method is out of place in the Grammar School. The moulding board should be freely used and the teacher ought to know how to use it. Frye's Sand Modeling and Parker's "How to Study Geography," furnish ample information. These books may be obtained from the Free Public Library. In studying political geography the teacher should give attention to History. This will involve the consideration not only of the history of our own country but also that of other countries, as current topics.

In studying the various countries, history, language and literature should be correlated with geography. For instance, in the study of France the pupil should learn something of Napoleon. In the study of our own country and Great Britain, the pupil should become acquainted with the names and works of some of the most famous writers of these two countries.

The teacher can add interest to the study by making, with the aid of her pupils, a collection of pictures. These pictures should be classified and kept in an orderly manner, so that they may be available. Children should be encouraged to obtain information, on the subject matter, outside of the text book. Encourage the pupils to search encyclopaedias, books of reference and to read good books of travel. Have a scrap book or two. Encourage the children to cut from the papers articles bearing on the subject. Have map drawing in each grade. Have the pupils use progressive outline maps. Stencil maps will be very helpful to the teacher in placing her progressive map on the board. To secure uniformity the following directions are given for coloring maps:

Artificial boundaries	Red
Shores of large bodies of water and coasts	White
Small interior lakes and coasts	Blue
Cities	Yellow
Mountains	Brown
Railroads	Dotted pink lines
Journeys	Orange

Use the journey method as far as possible. The advantages of this method are three-fold. In addition to greater interest it awakens in the work, the pupils learn not only the political geography, but the physical, commercial and historical as well, of a country or place. The required information cannot be gleaned exclusively from the class text-book, but the pupils are obliged to search for their subject matter in encyclopaedias, etc., and by so doing acquire the habit of searching books for valuable information. And, lastly, every lesson is an important, practical lesson in language.

With the aid of pupils, establish a school room museum. Not for the purpose of having a cabinet filled with choice minerals, productions, manufactured articles and woods, but that these specimens may be at hand when needed for the work. So far as possible, in every grade the pupils should be required to make relief maps of papier mache or pulp. This is easily done by tearing a common newspaper into irregular bits about one inch square. Place these pieces in a pail, and add enough boiling water to cover the paper. Let it stand for four or five hours. Draw off the excess of water until the paper lies as a pasty mass. Use a rough stick to beat and grind the paper until it becomes a pulpy mass. In ten minutes enough pulp can be made for three or four maps. Do not use glazed paper.

GENERAL SUGGESTIONS TO TEACHERS.

Make the lesson your own before you attempt to teach it. Have your lesson well planned. Make notes of the facts to be brought out. Always be logical; let each lesson grow out of the preceding one. Prepare a list of the new words and place them upon the board for spelling, pronunciation and definition. See that your pupils copy and study regularly the spelling of geographical names. Make excursions with your pupils, if possible. Do yourself what you require of your pupils. Do not permit the children of the lower grades to use notes. Read interesting articles; show pictures, specimens of wood and minerals. Always have a map at hand for reference. Always plan several drills for the class, of your regularly planned lesson. Insist upon complete sentences in recitations.

PRIMARY DEPARTMENT.

FIRST AND SECOND GRADES.

Study of plants and animals and natural phenomena to be carried on in connection with nature study and language.

Observing weather.
Making calendars.

THIRD GRADE.

"B" CLASS. FIRST TEN WEEKS.

1—Use "Seven Little Sisters" as a guide.
  (a) Prepare topics on subject matter.
  (b) Give conversational lessons.
  (c) Write such "catch words" as home, door, window, etc., on the board.
  (d) After each conversational lesson write a little story of the same on the board.
  (e) Oral reproduction.

(f) Have the pupils copy the story in their note books.

SUGGESTIONS—To give additional interest to the work present to the class pictures of countries visited. Make model of homes and dress dolls to show the costumes of the people.

OUTLINE OF LESSON ON THE ESQUIMAUX.

1—Home of the little girl Agoonack; house, dress, family, etc.

2—Climate; day and night; plants.

3—Animals; seal, dog, fish, birds, etc.

SECOND TEN WEEKS.

I.—Points of compass.

II.—Lessons on rain, snow, dew, ice, water, etc.

SUBJECT MATTER—

1—Direction of shadow at noon is toward the North.

2—When you face the North, the South will be at your back; East at your right hand and the West at your left.

3—Half way between North and East is North-east.

4—Half way between South and East is South-east, etc.

5—Observe different lengths of shadows and discover when they are shortest, longest.

6—Have pupils watch their own shadows moving at noon and night.

7—Ask them to notice that the sun does not rise in the East, exactly, at all times, but near it.

8—Only twice each year is the sun in the direct East or West.

SUGGESTIONS.

1—Give the lesson if possible on a sunny day when the shadows are distinct.

2—Use the shadows of the window sash or any other upright line at noon as the starting point, because the sun does not rise in the exact East but twice a year.

3—Explain that the sun rises near the East.

4—Drill on the points of the compass.

Draw this figure:—

2	3	4
9	1	5
8	7	6

Ask many questions such as: Direction from 1 to 6; 1 to 5, etc. What objects are in the north side of the room? etc. Show compass and teach its use. Make a drawing of it on the board. Have a conversation about its invention.

DRAWING LESSON.

Before attempting to draw a map of the city, the pupil should know vertical and parallel lines; angles and rectangles. Draw rectangles of given length and width in inches. Show that large objects cannot be drawn full size upon their small sheets of paper and the necessity of small pictures in correct proportion. Teacher measures objects and pupils draw under supervision. At this point lessons on the physical features near at hand should be given, such as hills, valleys, slopes, ridges, divides, springs, beds of streams and banks. Kinds of soil and work of water. Use the moulding board.

Draw map of school-room on reduced scale one-fourth of an inch to a foot. Pupils compare maps with room, note boundaries and their directions. Draw map of school grounds, of farms, locating cornfields, brooks, pastures, etc.

Lessons on rain, snow, ice, dew, water, etc.

THIRD GRADE.

"A" CLASS—

I.—Local geography and history.
II.—Special Lessons.

Teacher should be familiar with the subject before she attempts to teach it. Draw map of city on board. Have pupils describe while teacher draws. Make the lesson conversational. It is best to begin with the street near the school, unless you desire another street as a better starting point. If it is in winter time teach physical features by using pictures, sand boards, etc. Take journeys through the city. Make boundary, giving term; give historical features. Classify knowledge in conformity with the following outline:

I.—Description of city.

- 1—Streets.
  - (a) names.
  - (b) description.
- 2—Bridges, ferries.
  - (a) length.
  - (b) kinds.
- 3—Railroads.
  - (a) names.
- 4—Public Buildings.
  - (a) names.
  - (b) location.
- 5—Educational Institutions.
  - (a) names.
  - (b) location.
  - (c) use.
- 6—Banks.
  - (a) names.
  - (b) location.
- 7—Churches.
  - (a) names.
  - (b) location.
- 8—Manufactures.
  - (a) kind.
  - (b) location.

II.—Inhabitants.
  1—Nationality.
  2—History.
  3—Occupation.
  4—Number.

III.—Government (why necessary).
  1—Officers.
    (a) names.
    (b) how many?
    (c) duties.

IV.—Surroundings.
  1—River.
    (a) names.
    (b) source.
    (c) mouth.

  2—Artificial boundaries.
    (a) on north.
    (b) on south.
    (c) on east.
    (d) on west.

The lessons on City should be followed by lessons on chief industries and the reasons for them.

The following natural objects should be studied and located as found:

I.—Slight elevation of land is a hill.
  1—Top is the summit.

2—Foot is the base.
3—Side is the slope.

II.—Lowland is called swamp, marsh, meadow.

III.—Water rising out of the ground is called a spring.

IV.—Small stream is called a creek.

V.—Large stream is called a river.

1—The place where a creek or river begins is called its source.
2—Place where a creek or river flows into some other water is its mouth.
3—Toward the source is up stream.
4—Toward the mouth is down stream.
5—Land bordering both sides of a stream is called its banks.
  (a) The bank on the right as you go down stream is the right bank.
  (b) The bank on the left as you go down stream is the left bank.
6—An inward bend in one of the banks is called a bay.
7—Land under the river is called its bed.
8—Water flowing rapidly over a sloping bed is called rapids.
9—River or creek flowing into another stream is a branch of that stream.

10—A portion of land surrounded by water is called an island.

11—A portion of land almost surrounded by water is called a peninsula.

12—Uses of river and creek.

  (a) To moisten and drain land bordering on them.

  (b) Rivers can be used to turn machinery and furnish water-power. (Illustrate).

Discuss other uses of rivers, as for water supply, boating, transportation. Lead pupils to talk of different kinds of work, as farming, trades, teaching, etc. Form statements. (Term "business" is an idiom of New York and surroundings.) Work to gain a living is called occupation. Discuss and locate important occupations.

Making articles by hand or by machinery is manufacturing.

To complete representation of city, trace each street to its limit. Draw line to mark boundaries. Teach that the line which marks off city is its boundary. Any interesting fact concerning early settlers, first buildings erected, etc., may be taught in connection with work on city.

Develop idea of square mile, and by comparison lead pupils to discover area of city.

CLIMATE—Conversational lessons on weather. Teach use of thermometer and weather.

Teacher gives weather reports for a week from various sections. By questioning, pupils are led to state:

1—The amount of heat and moisture in the air for a short time makes up the weather. By reviewing the temperature and amount of rain or snow in the city for the different seasons, we get the average amount of heat and moisture for the year.

2—The average weather in any place is the climate of that place. By referring to the productions pupils will recall the changes in climate, as they travel North or South in the State. They will also remember and be led to state that the climate is changed or modified by altitude and nearness to large bodies of water.

Pupils should be taught that temperature varies about three degrees for each thousand feet of altitude, and they may be led to tell the temperature at the summit of mountains when that at the base is given.

FOURTH GRADE.

"B" CLASS. FIRST TWENTY WEEKS.

A—COUNTY (Hudson, originally part of Bergen).

B—STATE (NEW JERSEY).

C—GLOBE.

Climate: Review work on Climate as given in Third Year.

HUDSON COUNTY.

The land of the County is uneven; the higher portions are called highlands and the lower portions lowlands.

TEACH:—

1—Land extending from the high to the low land is the slope.

2—A broad portion of lowland is a plain.

OCCUPATIONS—Apply those previously taught and add:

1—Raising useful plants is farming or agriculture.

2—Getting stones out of a quarry is quarrying.

PRODUCTIONS—From occupations obtain productions and locate them by name on map, using colored crayons.

TOWNS:—

1—Names.
2—Location.
3—Distance from Hoboken.
4—Size compared with Hoboken.
5—Occupations and Productions.
6—Description of Public Buildings.
7—Interesting History.

NOTE:—When pupils are not familiar with interesting features of Town and County use pictures to illustrate. Do the work by taking imaginary drives, etc.

Have pupils make a progressive map of County, locating all towns visited and indicate route taken by dotted line. The last week on the County should be spent in classifying the knowledge as follows:

1—Shape and boundaries.
2—Size: Sq. miles.
3—Surface.
  (a) Character and slope of land.
  (b) Water: rivers, creeks, lakes and canals.
4—Occupations.
5—Productions.
6—Villages, towns, cities.

STATE OF NEW JERSEY.

Use wall maps at first. Before taking the journeys study the State as a whole, as to boundaries and principal physical features, natural and artificial boundaries. Study the mountains, rivers, lakes, soil, productions, mines and quarries. Teach the slope of the land from the direction of the rivers. Dwell on the character of the soil, variety of crops, mining and commerce. Teach four or five of the principal railroads showing the importance of railroads to the people.

Encourage children to bring samples of the manufactures of the City and State. Use pictures. Read to pupils interesting stories germane to the subject. The teacher should now in a very simple way begin to introduce history of the places studied. Tell story of the settlement of Jersey City, Hoboken, Elizabeth, Trenton, etc. Tell story of George Washington, the Hessians, Battle of Trenton. Tell why the English were fighting the Americans. Tell why we celebrate Feb. 22d, July 4th. Stories about Dutch settlers, their houses, furniture, food, clothing, amusements, etc. In the same way tell about the English settlements; stories of the Quakers and their settlements. Tell about the battles of Trenton, Princeton and Monmouth. Washington's journey to his inauguration. Teach Governor's name and leading State officials.

The foregoing history topics are suggested. It is not necessary to refer to them all; the purpose in suggesting them is to indicate a proper direction of the teaching.

Teach what you think a fairly intelligent Hoboken boy or girl of the fourth grade ought to know about Jersey City, Newark, Paterson, Elizabeth, Trenton, Camden, etc. Take a journey to each of these cities.

Teach by map study, map drawing and sand modeling. Illustrate by drawings on the board. Give pupils opportunity to tell what they have learned from other sources than the text book. Have pupils make progressive maps. When pupils have completed the work, have them produce on heavy drawing paper a map of the State, showing principal cities, rivers, lakes, railroads and canals. When this work has been completed, pupils should be lead to classify knowledge obtained according to the following form:

I.—Boundaries.
  1—Natural.
  2—Artificial.

II.—Shape.
III.—Size, relative compared with County.
IV.—Surface.
- 1—Land.
  - (a) highlands.
    - 1—plateau.
    - 2—hills.
    - 3—water-shed.
    - 4—mountains.
  - (b) slopes.
  - (c) lowlands.
    - 1—plains.
    - 2—valleys.
  - (d) river basins.
- 2—Water.
  - (a) rivers.
    - 1—systems.
    - 2—single streams.
  - (b) lakes.

V.—Climate.
VI.—Natural Wealth.
- 1—fertile soil.
- 2—mines, quarries.
- 3—forests.

VII.—Occupations.
- 1—agriculture.
- 2—cattle raising.
- 3—mining.
- 4—lumbering.
- 5—manufacturing.
- 6—commerce.

VIII.--Productions.

IX.—Exports.

X.—History.

SPECIAL LESSONS.

1—Ocean: A conversational lesson in which size, wave, color, sound, etc., are to be discussed.

2—Land bordering on the ocean is called the coast.

3—A portion of land almost surrounded by water is called a peninsula.

4—A portion of water connecting a larger body of water is a strait or channel.

5—A place where vessels can be moored safely is a harbor.

6—A single mountain top is called a peak.

7—Several peaks together—a group.

8—Line of mountains—a range or chain.

9—Broad extent of highlands is a plateau.

10—Waters which help to form a river are its tributaries.

11—A river with its tributaries is a river system (compare with trees).

12—A highland separating river systems is called a watershed.

13—A portion of land drained by a river system is a river basin.

14—Getting other minerals than stone from the ground is mining.

FIRST GLOBE LESSON.

Pupils are now familiar with the idea of ocean—Atlantic.

Before globe lessons are given, they should have a general idea of continents—North America.

This should include something of extent, watersheds, slopes, river systems, etc. Use relief and stencil maps. The pupils are now ready for the following lessons:

1—We live upon the surface of the earth.

2—The earth is round like a ball.

3—The surface of the earth is everywhere curved but does not appear so to us because we see so little of it at one time.

NOTE:—Illustrate this by placing over a ball a sheet of paper in which a small incision has been made.

4—The earth rests upon nothing.

(Illustrate by toy balloons, soap-bubbles, etc., thus leading the child to the conception of the fact that the great round ball, the Earth, is floating in space.)

Some conception of size may be given from the length of time required to walk around the world.

5—The Earth is lighted by the Sun. (Sun does not pass around the Earth, but Earth turns or rotates; this causes day and night.)

Each of the above facts should be taught in conversational lessons.

6—Appeal to the imagination; illustrate freely; being careful to keep before pupils the point illustrated.

7—A ball with a map on the surface to represent the surface of the earth is called a globe or sphere.

8—Half a sphere is a hemisphere.

9—The line upon which the earth rotates is called its axis.

10—On the surface towards the upper end of the axis is north. Towards the lower end is south.

11—The upper end is the North Pole.

12—The lower end is the South Pole.

13—When facing north the right hand points east and the left hand points west.

14—The largest bodies of water are the oceans. Pupils should be taught to name and locate them on the globe.

15—The land is divided into continents, islands, etc.

FOURTH GRADE.

"A" CLASS:—

The class is now ready for the text book.

1—Imaginary journeys around the world, teaching size and shape of the earth, nations, zones and essential mathematical and physical features.

2—Races:

(a) white.
(b) black.
(c) red. } Their homes, habits, occupations.
(d) yellow.
(e) brown.

3—Local observations and field lessons with drawing and scale of such familiar places as the school-room and school-yard, acquainting the children with the use of map.

4—North America.
  Historical.
    (a) Position and shape.
    (b) Coast line.
    (c) Islands.
    (d) Mountains.
    (e) Drainage.
    (f) People: { English speaking centers. Spanish speaking centers. French speaking centers.

5—Sub-division.
  United States.
    (a) Historical.
    (b) Position and shape.
    (c) Coast line (Study from large map types of Atlantic Coast.)
      1—Rocky or fiord coast from Maine to New York.
      2—Sandy or beach coast. First type has good harbors, second few good harbors; the first aids and the second obstructs commerce.
      3—Pacific Coast. Cliff and mountain type.
    (d) Relief.

(e) Drainage.
(f) Heat and Rainfall.
(g) Study by section.
    1—Northern. (Food producing).
    2—North-eastern. (Manufacturing).
    3—Southern. (Cotton producing).
    4—Western plateau. (Mining and grazing).
    5—Pacific. (Wool, fruit and wheat).
(h) Specialize on industries of each section
(i) Chief cities and towns. (Noted men and events connected with chief cities and towns).
(j) Minor countries of North America.

Redway's Natural Elementary Geography to page 71.

FIFTH GRADE.

"B" CLASS:—

South America, Europe, Asia, Africa, Australia and the Pacific Islands to be studied according to outline given for United States in fourth grade. Special attention to be paid to the correlation of history with the study of geography.

EUROPE:—More time should be devoted to the study of Europe and Asia than of the other divisions. Under the head of "people" in study of Europe divide them racially:

(a) Germanic in the north.
(b) Latin in the south.
(c) Slavonic or Russian in the east.

Emphasize the racial traits. The communal tendency of the Slavonic by means of stories of Russian farm life, can be made very interesting.

Redway's Natural Elementary Geography Completed.

FIFTH GRADE.

"A" CLASS:—

1—The earth as a whole.
  (a) Form and size.
  (b) Rotation and revolution.

2—Upheaval of the land.
  (a) The surface of the earth.
  (b) The continental plateaus.
  (c) Highlands and lowlands.

3—Coast.
  (a) Sandy and barren beaches.
  (b) Islands. (Partly submerged mountains.)

4—Work of streams.
  (a) Wearing away of the land.
  (b) Deposition of eroded material in valleys makes valley plains of high degree of fertility.
  (c) Atmospheric agents.
  (d) Glaciers.
  (e) Waves and tides.

5—Climate (reviewed).

- (a) Season.
- (b) Zones, heat belts.
- (c) Winds.
- (d) Rainfall.
- (e) Ocean currents.
- (f) Influence of climate upon racial traits.

6—Life.

- (a) Distribution largely the result of climate.
- (b) Great life region.
- (c) Islands and ocean life.

◁GRAMMAR DEPARTMENT.▷

SIXTH GRADE.

"B" CLASS:—

The pupils are now prepared to study Geography more specifically, introducing Redway's Natural Complete Geography.

UNITED STATES BY GROUPS—

In studying the United States by groups, consider the natural divisions based upon the physical features rather than the artificial and arbitrary ones given in most geographies. Make the study as picturesque as possible. Use as much literature as possible. Study somewhat more in detail as related to history, emphasizing physical features, occupations, productions, means of travel. Spend a few days in the study of the group as a whole. Position of group in the United States; nearness to ocean, to equator; winds, rainfalls, healthfulness of climate, general surface, physical features; what effect nearness to the ocean has upon the people; nearness to the equator.

Study the industries, customs, growth, people, points of interest and history. Journey from city to city mentioned in the text book and others as time will allow. Observe the surface and crops en route. Make the journey as real as possible, getting information from the car windows, from conversations, etc., as though upon a real journey. Use text book chiefly for map study.

Encourage the children to use the encyclopaedias and other reference books. Insist upon the children doing the work. The teacher should question so as to lead the class to see the connection of important facts. Do not omit spelling lessons. Have pupils keep note books in which to note once a week the various journeys taken. The teacher should keep an outline map on the board and locate places studied. Indicate the route taken by a dotted line. Each pupil should have an outline map and should fill in the map as the journey progresses. The outline maps should be collected at the close of each lesson and distributed again when it is necessary to locate places. As soon as each group is completed, the knowledge gained should be arranged in accordance with the following classification:

CLASSIFICATION OF GROUP—

I.—Position.
    1—In United States.
    2—Near what water?

II.—Latitude.

III.—Climate.

IV.—Surface.
    1—General character—high, low, swampy.
    2—Mountains.
    3—Slopes or valleys.
    4—Chief rivers.

V.—Soil.

VI.—Productions.

VII.—Densest population—where?

VIII.—Cities.
    1—Capital.
    2—Chief city.

IX—Principal occupations.

X.—History.

XI.—Principal, schools and colleges.
    (a) Name.
    (b) City.
    (c) State.

SIXTH GRADE.

"A" CLASS:—

UNITED STATES BY GROUPS. CONTINENTS—

Give lessons upon the chief productions, as cotton, wheat, oats, tobacco, fruits, minerals and woods. Study the region in which they are found as regards climate and soil. Have pupils make relief and productive maps. When the work of this grade has been completed, have the pupils make the following classification of their knowledge:

CLASSIFICATION OF WORK ON THE UNITED STATES:—

I.—POSITION.
    1—Continents.
    2—Boundaries.

II.—FORM.

- 1—General.
    - (a) Projections.
        - 1—Peninsulas.
        - 2—Capes.
    - (b) Indentations.
        - 1—Gulfs.
        - 2—Bays.
    - (c) Straits, channels and sounds.
    - (d) Islands.

III.—SIZE.

- 1—Relative.
    - (a) Compared with New Jersey.
    - (b) Compared with North America.
- 2—Real.
    - (a) Length.
    - (b) Width.
    - (c) Area.

IV.—SURFACE.

- 1—Land.
    - (a) Highlands.
        - 1—Appalachian.
            - (a) Plateau.
            - (b) Ranges.
            - (c) Groups.
            - (d) Peaks.
        - 2—Rocky. (Same as Appalachian.)
        - 3—Pacific. (Same as Appalachian.)

- (b) Slopes.
- (c) Basin.
- (d) Lowlands.
  - 1—Plains.
  - 2—Swamps.

2—Water.

- (a) River.
  - 1—Systems.
  - 2—Single streams.
- (b) Lakes.

V.—CLIMATE.

1—Summer isotherms.
Winter isotherms.
Annual isotherms.
2—Distribution of rainfall.

VI.—NATURAL WEALTH.

VII.—OCCUPATIONS.

VIII.—PRODUCTIONS.

IX.—PRINCIPAL CITIES.

X.—IMPORTANT LINES OF TRAVEL AND TRANSPORTATION.

1—Railroads.
2—Canals.

XI.—EXPORTS.

XII.—IMPORTS.

XIII.—GOVERNMENT.

XIV.—DIVISION.

- 1—States—how many and what called?
- 2—Territories—how many and what called?
- 3—Public Lands.

XV.—LIFE.

- 1—Vegetation.
- 2—Animals.
- 3—People.
  - (a) Personal appearance and dress.
  - (b) Civilization and education.
  - (c) History.
  - (d) Race.

Last six weeks.

MEXICO and CANADA—Journey from place to place and classify according to form given for work on State. Give a week or two to the study of North America as a whole. Classify as for the United States.

SEVENTH GRADE.

"B" CLASS:—

ADVANCED GLOBE LESSONS.

Review previous globe lessons and proceed as follows:

I.—FORM. Spherical.

- 1—Proofs.
  - (a) Traveling around the world.
  - (b) Appearance of ships at sea.

(Other proofs may be given if pupils are able to comprehend.)

II.—SIZE. Review circle, circumference, diameter.

1—Distance round the earth or circumference is about 25,000 miles.

2—Distance through the earth or diameter is about 8,000 miles.

3—Area about 197,000,000 square miles.

III.—MOTIONS. Review rotation and give the following lessons:

1—Circles of the earth.

(a) Kinds.

1—Circles which divide the earth equally are called great circles.

2—Circles which divide the earth unequally are small circles.

(b) Divisions.

1—Every circumference, whether great or small, is considered as divided into 360 equal parts, each called a degree. Sign (°).

2—Every degree is divided into 60 equal parts called minutes. Sign (').

3—Every minutes is divided into 60 equal parts, called seconds. Sign ('').

(c) Names.

1—The great circle midway between the poles is called the Equator.

  - 2—The small circles extending parallel with the Equator are parallels.
  - 3—The half of a great circle extending from pole to pole is called a meridian.
- (d) Uses.
  - 1—The distance of a place north or south of the Equator is its latitude.
  - 2—Latitude is measured on a meridian in degrees, minutes and seconds.
  - 3—Every parallel passes through places which have the same latitude, and is therefore called a parallel of latitude.
  - 4—There can be 90 degrees north latitude or 90 degrees south latitude.
  - 5—Distance east or west from a particular meridian is its longitude.
    - (a) East longitude.
    - (b) West longitude.
  - 6—The longitude of a place is reckoned on the Equator, or on the parallel which passes through that place.

7—The meridian of Greenwich or Washington is taken as the one from which we reckon longitude and is called the First Prime Meridian.

8—All places through which a meridian passes have the same longitude.

(a) There can be but 180 deg. east longitude.

(b) There can be but 180 deg. west longitude.

9—Give practical examples in longitude and time.

(e) Comparison.

1—The parallels grow smaller in going from the Equator to the poles.

2—At equal distances from the poles the parallels are equal.

3—The degrees of longitude grow smaller in going from the Equator to the poles.

(f) Application and drill.

1—Locate by latitude prominent capes, cities, mountains.

2—Locate same by longitude.

            - 3—Find cities, natural curiosities, etc., latitude and longitude being given.
            - 4—Starting from a given latitude and longitude, travel north or south, then east or west, a definite number of degrees, and determine the latitude and longitude of point reached.
            - 5—A place in west longitude being given, find a corresponding place in east longitude.

(Many other methods will suggest themselves to the teacher as the work progresses.)

- 2—Rotation.
    - (a) Time.
    - (b) Effect.
        - 1—Day and night.
        - 2—Location of poles, axis and meridians.

(Pupils should be taught to solve problems in longitude and time.)

Using knowledge possessed by pupils regarding seasons, proceed to develop cause for change of seasons.

- 3—Revolution.
    - (a) Time—365¼ days (solar).
    - (b) Effects.

1—Division of time into years.
2—When combined with inclination and parallelism of axis and rotation causes
  (a) Change of seasons.
  (b) Locates tropics and polar circles, thus fixing boundaries of zones.

(Develop idea of solar system; teach names of planets and some of the facts in regard to the relative size, position, characteristics and time of revolution.)

In teaching globe lessons, each point must be clearly understood before the next is presented. Lead children to observe closely, and state results of observations.

SEVENTH GRADE.

"A" CLASS:—

(a) South America.
(b) British Isles.

Plan journeys to cover the work of South America. Use the plan for North America, but not entering quite as much into details. Lay great stress on the physical features; climate; why cities are so situated. Relations, commercial and otherwise to us. Dwell especially on the basins of the Orinoco, Amazon, and Rio de la Plata, giving their products both natural and cultivated. Make it clear to the children why there is so much rain on the east side of the Andes in equatorial South America, and so little on the west side, while in the southern part of the continent the most rain is on the west side. Show that altitude has more to do than latitude in determining climate, and consequently vegetable and animal life in this continent. At the same time you must be careful not to give the impression that latitude is to be ignored; it counts for much even in South America. Consider the people, their race, homes, education, government, occupations, etc. Map Drawing. Children should make relief maps in sand, clay, papier-mache or other material. Classify work using form given for the United States. Historical Geography: English, Spanish, French and Dutch explorations and settlements to be studied. Tell stories of Columbus, Cortez, Magellan, Sir Francis Drake, Bolivar, etc.

BRITISH ISLES.

Plan journeys. To make it interesting imagine that you are personally conducting your pupils on a tour through these interesting countries. You leave the steamer at Queenstown. Visit Youghal (home of Sir Walter Raleigh; first potatoes were planted here); Cork, the great dairy market of the Kingdom; Killarney, for its unsurpassed scenery, etc.; Limerick, its interesting historical ruins; Dublin, the capital; Belfast, for its great linen manufactures; give a lesson on linen, etc.; the Giant's Causeway; tell legend and talk about surface; reason for mild climate; productions; customs of people, etc.

SCOTLAND: Visit the following places: Glasgow, Ayr (the birthplace of Burns); read some of Burns'

Poems. The Highlands, visiting two of the lakes using extracts from Scott's "Lady of the Lake." Poor soil in the north, why? Edinburgh, Dundee, Aberdeen. Read Scott's Tales of a Grandfather. Consider the occupations of the people, their customs, homes, etc. Study the physical features of the country; explain firth, loch; its comparative size; historical facts.

WALES: Surface, minerals, customs, manners, language of the Welsh.

ENGLAND: Plan journeys to take in the following places: Liverpool, Leeds, Hull, Manchester, Sheffield, Nottingham, Birmingham, Oxford, Stratford-on-Avon, Bristol, Plymouth, Southampton, Brighton, Dover, Cambridge, London. Study the Thames, Tyne, Severn and Mersey Rivers. Why are nearly all of the manufacturing cities in the north? Commerce. Agriculture. The physical features. Productions. Government. Manufactures. Geographical history. English History. topics suggested: The growth of constitutional liberty, Magna Charta, The Age of Elizabeth, The Age of Victoria. Map drawing. Relief maps. Classification of knowledge.

EIGHTH GRADE.

"B" CLASS:—

EUROPE.

Plan imaginary journeys. Study physical features, river systems, mountains, commercial relations, character and occupations of the people, government. In considering productions, treat especially of those which have commercial bearing upon this country. Map drawing. Relief maps. Progressive maps. Modeling. Classify knowledge. Urge pupils to read books of travel. Do not labor under the mistaken idea that the more places a pupil can name and locate the more he knows about geography. It is not necessarily true. Be thorough. Fix things so that they will stay. Keep reviewing constantly. Use sand, chalk, pictures and pencil freely.

Historical topics suggested:

Feudalism.
Chivalry.
Crusades.
French Revolution.
Napoleon.
Battle of Waterloo.
Evolution of German Empire.
William Tell.
Peter the Great.
Alexander the Great.
Julius Caesar.

EIGHTH GRADE.

"A" CLASS.

ASIA.

Plan imaginary journeys. Study physical features. drainage, river systems, mountains, commercial relations, character and occupations of people, government. Note that the principle mountains and plateaus are in the interior while the plains are on the borders of the continent.

Compare in this respect with North America. Consider why the great northern plain has a cold climate and a barren soil. Notice the scarcity of lakes in the interior. Compare in this respect with North America. Take a journey through the various countries in the following order:

CHINA—Study slope of country; two great rivers; the climate and cultivated products; compare in these respects with the United States. Study the people—their occupations, homes, customs, costumes, food, manner of life, etc.; manufactures, commerce, education, government. Visit Peking, Shang-hai, Hong Kong, Canton. Give a lesson on "tea raising."

JAPAN—Visit the three largest islands. Consider same topics as for China.

COREA—Study Corea and its people.

ANAM and SIAM should receive but slight attention.. Study people and productions. Do not fail to visit Singapore? why?

INDIA—This country is worthy of much attention. Study it as you did China, but with a greater degree of fulness. Dwell especially on the basin of the Ganges and its products. Visit the following cities: Calcutta, Delhai, Madras, Bombay, Benares. Pass over the remaining countries quite rapidly until you reach Palestine. Give a lesson on coffee industry.

PALESTINE—This little country, because of its past history and associations, is worthy of careful attention. Talk of the oldest countries when human history began.

Explain that it was in the fertile river basins of the Euphrates and Tigris that civilization began.

Historical subjects suggested:
Historical tales of the East.
Stories of the Great Nations of Europe.
Stories of the Great Migrations.

NINTH GRADE.

"B" CLASS.

(a) Africa.
(b) Oceanica.
(c) Commercial Geography.

AFRICA.

Do not spend too much time on this continent. Devote most of your time to a study of the coast line, surface, a few rivers, the countries of the North (especially Egypt) the countries of the South and the Congo Free States. Teach such cities as you think a fairly intelligent boy or girl ought to know.

OCEANICA—Devote most of the time to Australia, the Hawaiian and Phillipine Islands. Study surface; climate and productions.

Take imaginary voyages to principal seaports; North America—on the Atlantic, Gulf, Pacific; Mississippi, Hudson and St. Lawrence rivers; South America, British Isles, Germany, France, Netherlands, Spain, Portugal, Italy, Russia, Turkey, Africa, India, China, Japan, Australia, Hawaiian Islands.

Products to be taken to and brought from each. Travel by land along great trunk lines of North America and in other countries, noting the life, the scenery, the productions, industries of the sections passed through. Have the pupils make productive maps.

Historical topics suggested:

Stories of Egypt.
Stories of explorations.

Note commercial countries and centers; the centers in food, clothing, metals, raw materials and manufactured goods.

NINTH GRADE.

"A" CLASS—

ASTRONOMICAL GEOGRAPHY.

During this term the pupils study the Earth as a part of the solar system and the effects of its relation to the rest of the system upon itself and its inhabitants. Treat briefly the geological history of the Earth. The motions of the Earth. Causes of day, night, seasons, tides, currents, winds and other effects of the Earth's relations to the planetary system.

WEATHER OBSERVATIONS.

To consist in the first grade of the simple daily observations of the weather, taken at the beginning of school, and the making of a chart filled in with pictures mainly.

Sunshine.
Clouds.
Rain.
Fog.
Snow.

Short talks with the children about the weather. In the spring, spring rains, softening of the earth, warmer days, etc., etc., an aid to plant world.

Throughout the succeeding years the daily record to be kept up, using words as soon as possible, and enlarging chart by progressive steps, year by year, including the record of temperature, direction of wind, date and time of observation, etc.

HISTORY.

In the teaching of history, the teacher should aim to develop a taste and a genuine love for historical reading, instead of memorizing numberless facts and innumerable dates. The study of Geography should be intimately associated with history and woven in the work of language.

In order to make the subject attractive, teachers should make free use of stories, anecdotes, biographical sketches, pictures and reference books. Outline maps of North America and of the United States should be constantly consulted. As far as practical, have the pupils make progressive maps. Sketches on the blackboard of camps, routes, battle-grounds, campaigns, cities, and their surroundings are of material assistance. Much importance should be attached to peace periods and the industrial progress of our country. In dealing with war periods, lay stress on causes and results. No study affords the teacher better opportunities for inculcating a spirit of patriotism and for impressing the duties of good citizenship.

Lessons on good conduct and government as outlined in the lowest grades should be given by the teacher incidentally. The work is given in these grades with the hope that its use will lead boys and girls to a keener sense of personal responsibility for good government and for the proper treatment of their fellowmen. The events of European history which bear on our own history should be taught in a simple manner. With the purpose of making history real, attention should be paid to birthdays, anniversaries and current events. From time to time the events of local history should be considered; historical localities, buildings and monuments described.

Commencing with the sixth grade the subject should be taught topically. In the higher grades, the aim in American history should be to give a clear understanding of the development of our national life, socially, politically and territorially. In teaching the development of the United States certain great historical movements should be kept in view. From the discovery of America to the close of the French and Indian War, the great question is: What nationality and what language are to dominate in North America? All discoveries, explorations, settlements, and wars are more or less important as they bear on the decision of this question. After the English dominance is established, another question looms up: Is America to be a dependency of England or to cut loose from the Mother Country? The antecedents of the Revolutionary War and the War itself, should be studied with this question in view. Scarcely is this problem settled before another begins to demand attention: Are the independent colonies to be separate nations, a loose aggregation of states or one nation?

The history of the Articles of Confederation, the disputes on the adoption of the Constitution, the position of the early political parties, the acquisition of territory, the slavery troubles and the Civil War should all be studied with this main question before the mind. The boy or girl who is brought to understand and feel these questions and has learned a sufficient number of facts and details, may be said to understand American history. Encourage the children to seek for information outside of text-books.

◁PRIMARY DEPARTMENT.▷

FIRST GRADE.

CONDUCT AND GOVERNMENT.

Conduct and morals should be taught incidentally in connection with all school exercises. But this instruction is to be re-enforced by direct lessons on morals, manners and government. These lessons are to be based on the stories or fables read or told to children or on concrete examples found in every day life, in anecdotes, biographies, and maxims.

TOPICS FOR THE YEAR.

(a) Home life of the pupils. Birthdays.

(b) The School; location, name of the teacher, of the principal. The school-room, its number, care and use of furniture, books, etc.

(c) Stories told or read to inculcate a spirit of kindness to another, to brothers and sisters, to animals, obedience to parents and teachers, respect due the aged, gentleness, honesty, truthfulness and usefulness.

(d) Constant training in polite and courteous forms of speech.

(e) A few historical dates should be made attractive through exercises designed to form pleasing and moral associations. Especially Thanksgiving Day, Christmas, Washington's Birthday and Memorial Day. Teach the name of our country.

BOOKS OF REFERENCE:

"How to Teach Manners," Mrs. Julia H. Dewey; Moral Lessons in "School Management," by E. E. White; "Kindergarten Stories and Morning Talks," Sarah E. Wiltse; "The Story Hour," by Kate Douglas Wiggin; The Thanksgiving Day (from Story Hour). These books may be obtained from the Free Public Library.

SECOND GRADE.

CONDUCT AND GOVERNMENT.

(a) Stories and talks on generosity, unselfishness, punctuality. What we owe the weak and helpless. Suggest the idea of government and its necessity in the community of the school by referring to school regulations, such as bells, recesses, etc.

Books to be read—"The way to Obey," "Rollo Books," "The Honest Speller," "Suppose," by Phoebe Carey.

(b) The name of the teachers; of the principal; of the school; of the Superintendent and the Commissioners.

(c) The letter-carrier and his work. Letter-boxes, uses, etc.

(d) History Stories: The Boy Columbus, The Pilgrims at Plymouth; The First Thanksgiving Day; Christmas Day; Washington's Birthday, Memorial Day; The Offering of Flowers; Fourth of July.

Books to read: "The Boy Columbus," "Our Fatherland," "Carver and Pratt;" "The Settlement of Plymouth," from "Stories of a Grandfather," by N. S. Dodge. "The First Thanksgiving Day," in Story Hour, K. D. Wiggin; Stories of George Washington from the "The Story Hour," Poems and Songs for Memorial Day and the Fourth of July. These books may be obtained from the Free Public Library. Have children learn: "I pledge my allegiance to the flag and the country for which it stands, one nation indivisible, with liberty and justice for all."

THIRD GRADE.

CONDUCT AND GOVERNMENT.

(a) Illustrate by story and by examples found within the experience of the pupils, courage, cowardice; the difference between cowardice and timidity; between true and false bravery; the bully and true manliness.

(b) Some of the duties and privileges of the class as a community discussed; (a) of the class as a part of the school; (b) of the individual pupil as a member of the class.

(c) Duties of the Commission of Public Instruction. Something of what they do, as provide schools, teachers, furniture, books, etc.

(d) The Fire Department; duties and responsibility of the firemen; their bravery, etc.

(e) The Police Department; duties, etc.

READ—"Do All you Can," Margaret Sangster; "The Leak in the Dyke," Phoebe Carey.

"B" CLASS—

(a) Discovery of America by Columbus, emphasizing boyhood and perseverance of manhood.

(b) The Indians; appearance, manners and customs.

(c) Short story of settlement of Virginia.

(d) The Pilgrims. Story of the First Thanksgiving Celebration. Teach poem or part of poem "The First Thanksgiving Day." See Rhymes and Chimes of Holiday Times.

(e) Christmas. Teach suitable sentiment or poem. Teacher read Dicken's "Christmas Carol" to Class.

"A" CLASS—

(a) Stories of Colonial Times. Story of Penn and the Quakers. The names of the thirteen original colonies. Associate Washington with Virginia.

(b) Stories of the Revolution. Boston Boys and British Soldiers; Union of Thirteen Colonies. Teach words of "The Red, White and Blue."

(c) The Declaration of Independence. Why we celebrate Fourth of July. Read "The Flower of Liberty," Holmes.

BOOKS OF REFERENCE.

Stories of American History; and the Boston Tea Party, by N. S. Dodge.

FOURTH GRADE.

(a) Stories and talks upon self-control and perseverance. READ: "A Happy Life," Cowper; "Robert Bruce and the Spider."

(b) The City Government: The Mayor and Common Council; their duties; for the public good; as, see to paving of streets, keep city clean, healthful, etc., etc.

"B" CLASS—

(a) Daughter of Liberty. History of our Flag; have pupils memorize "Star Spangled Banner"; Washington's Christmas Surprise; Valley Forge; Lafayette; Israel Putnam; Surrender of Cornwallis. Read Mara L. Pratt's "American History Stories."

"A" CLASS—

The first President. The Installation of Washington; Thomas Jefferson; Duel between Hamilton and Burr; The Constitution and the Guerrier. Read "Old Ironsides," Holmes. Our Capital taken by the English. The first train of cars. Andrew Jackson.

FIFTH GRADE.

(a) Some of the duties as well as the privileges of citizenship discussed.

(b) Illustrate by examples, neatness, forming correct habits; the value of spare moments; little things.

(c) The County Government.

"B" CLASS—

Henry Clay, Daniel Webster, Captain Freemont, General Winfield Scott. Read "The Angels of Buena Vista." Election of Lincoln. Capture of Fort Sumpter. How armies were raised. Teach the words of "The Battle Cry of Freedom." The Merrimac and the Monitor.

"A" CLASS—

Gettysburg, Siege of Vicksburg, Sherman's March to the Sea, Surrender of Lee, End of War, The Emancipation Proclamation, New Jersey's part in the Civil War, Heroes of the War. Memorial Day. Read "Sheridan's Ride"; "Barbara Fritchie." The Blue and the Gray. Extracts from Lincoln's speech at Gettysburg.

⋖GRAMMAR DEPARTMENT.⋗

SIXTH GRADE.

"B" CLASS—

Use Eggleston's First Book on American History to page 101. The book is to be read and discussed, but not studied. Have the children give reproductions.

"A" CLASS—

Use Eggleston's First Book on American History—Completed.

SEVENTH GRADE.

"B" CLASS—

1—The mariner's compass.

2—Trade between Europe and India. Efforts to find easier method of communication. Vasco de Gama.

3—The Original inhabitants of America.
  (a) The mound-builders.
  (b) The Indians; mode of living; in peace, in war; food; dress, characteristics.

4—Discovery of America.
  (a) The Northmen.
  (b) Prevailing ideas of the shape of the Earth.
  (c) Columbus; his belief regarding its shape and size; efforts to fit out an expedition; difficulties; success.

5—Exploration.

- (a) Columbus. His voyage, etc. His return voyage. His reception. Effect of discovery on Europe.
- (b) Spanish. Ponce de Leon, Narvaez, De Soto.
- (c) English. The Cabots.
- (d) Dutch. Hudson.
- (e) French. Cartier, Champlain.

6—Settlement and Colonization. (In each case study the motive which inspired the settlement and the character of the settlers.

- (a) English. Virginia, Massachusetts, Pennsylvania, New York, the Jerseys, Connecticut, Delaware, Maryland and the Carolinas, Georgia.

Virginia 1607. All men. The search for gold and west passage to India. Sharing everything in common. Not much done till women came. John Smith, Pocahontas. Tobacco, the export. Massachusetts, Pilgrims and Puritan Persecutions. Hardships. Settlers of Virginia sought gold; of Massachusetts freedom of thought. The first Winter. No idlers. All workers. Boston. Harvard College. Thanksgiving. Read "Thanksgiving Story." "Courtship of Miles Standish." "Landing of the Pilgrims." In the same manner discuss the other settlements.

(b) The Dutch. New York and the Jerseys. First occupied by the Dutch. Ground of the English claim, etc. Read "Knickerbocker History of New York. Winfield's History of Hudson County.

(c) French. Canada.

(Note: Study the conditions of living in the colonies; the difficulties of transportation and communication; education, manners and customs; compare the prominent characteristics of the settlers in the different sections.)

7—The Intercolonial Wars.

8—The struggle between the English and the French for supremacy.

(a) Acadia. Read "Evangeline."
(b) Washington.
(c) Braddock's Defeat.
(d) Quebec. Montcalm and Wolf.
(e) Result of the War.

Eclectic Primary History to page 89.

"A" CLASS—

1—Condition of the people just before the Revolution.

(a) Social and industrial condition. Population. Implements and inventions unknown. The Printing Press, Postal service. Trades and occupations. Labor (the apprentice, "indented" servant, the redemptioner, the slave.) The cities. Travel. Navigation. State of agriculture.

(b) Government. The charter colonies—Connecticut, Massachusetts, Rhode Island. The proprietary colonies—Pennsylvania, Delaware and Mary land. The royal or provincial colonies—New Hampshire, New York, New Jersey Virginia, North and South Carolina and Georgia.

2—The Revolutionary War.

(a) Causes.

(b) Breaking out of the war. Boston Massacre. Concord, Lexington and Bunker Hill. Read in Holmes' Grandmother Story the following: Bunker Hill; Boston Tea Party; Lexington. (Read Paul Revere's Ride). The Continental Congress. British evacuate Boston.

3—Declaration of Independence. Some of the leaders. Independence Hall. Have pupils commit words of "Liberty Bell." Burgoyne's Defeat at Saratoga.

"One of the Fifteen Decisive Battles of the World." "Stars and Stripes" used for the first time. Have pupils commit words of "America." France promises to give aid. Franklin, Lafayette, Hancock, Morris. Principal battles, particularly those that occurred in New Jersey.

4—Results of the War.

5—Growth of the Nation.
  (a) Organization of the government.
  (b) Growth of Western States.

6—The War of 1812.
  (a) Causes.
  (b) Principal battles.
  (c) Results.

Have pupils commit "The Star Spangled Banner."

7—The War with Mexico.
  (a) Causes.
  (b) Principal battles.
  (c) Results.

8—The Great Civil War.
  (a) Causes.
  (b) Principal battles.
  (c) Prominent generals.
  (d) Results.
  Read Stowe's "Uncle Tom's Cabin."

Eclectic Primary History completed.

EIGHTH GRADE.

"B" CLASS—

1—Review the struggle for independence.

2—The struggle for a government.
    (a) The social condition.
    (b) The financial condition.
    (c) The political condition.

3—The Articles of Confederation.
    (a) Government under Articles of Confederation.
    (b) Defects of the Articles of Confederation and the results of the defects.
    (c) Constitution convention called.

4—Making the Constitution.
    (a) The convention.
    (b) Proceedings; the compromises.
    (c) Ratification by States.
    (d) Transfer of the government from the Articles of Confederation to the Constitution. (Have pupils commit Preamble to the Constitution.)

5—The rise of political parties.

6—The struggle for neutrality.

7—The struggle for our sailors' rights.

8—The war for commercial independence.

9—The industrial development of our country.

10—Civil Government.

1—National.
    (a) Who makes the laws?
    (b) Who executes the laws?
    (c) Who pass upon the operation or validity of laws?

2—State.

Teach as indicated for National.

Have pupils notice elections and teach their purpose.

EIGHTH GRADE.

"A" CLASS—

1—The industrial development of our country from 1789 to 1860.

2—Settlement of our boundaries.

3—The Rising West. Read Julian Ralph's "The Great West," and Roosevelt's "Winning of the West."

4—The Highways of Trade and Commerce.

5—Extension of transportation facilities. Its effects upon our country's development.

6—The political struggle from 1820 to 1860.

7—The Mexican War. Acquisition of territory.

8—CIVIL GOVERNMENT.

1—National.

(a) President, election, term of office, duties.

(b) Congress, composition, election of members, terms of office, duties.

(c) Judges, appointments, term of office, duties.

2—State.

Follow plan given above.

NINTH GRADE.

"B" CLASS—

1—The growth of the slave power.

2—Civil War to present time.
  - (a) Causes of our Civil War.
  - (b) War for the Union 1861-5.
  - (c) Results of the War.
  - (d) Reconstruction of the South.
  - (c) Industrial development since the War.
  - (f) Territorial growth of our country.

NINTH GRADE.

"A" CLASS—

1—General review.

2—The growth of our country as promoted by statesmanship, literature, inventions, manufactures and commerce. Pay special attention to growth of American lierature, literary men and their works. There should be occasional discussion of such topics of contemporary history as arrest the attention of thoughtful people.

3—Civil Government.

1—National.
  - (a) The most important features of the articles of Confederation.
  - (b) Formation of Constitution.

(c) Study the Constitution. It is not necessary nor desirable that pupils should memorize it. They should become familiar with its most important provisions. Emphasize the separation of the executive, the legislative and the judicial departments. Study the amendments, their purpose and when added. Have pupils learn the names and duties of the most prominent officials. Encourage them to notice current events and the acts of officials for the purpose of becoming familiar with the practical operation of the Constitution.

2—State.
  (a) Departments, principal officials and their duties.
  (b) Compare with National Government.
  (c) Encourage pupils to read State Constitution.

3—City.
  (a) Departments, principal officials and their duties.

4—Taxation.
  (a) National.
  (b) State.
  (c) Local.

5—Compare our government with the governments of other countries.

LANGUAGE LESSONS AND GRAMMAR.

The prime object of language teaching is to enable pupils to express their thoughts fluently and in appropriate language, and further, to teach them enough of the science of language to form a sound basis for future work in the advanced study of the mother tongue.

To do this well, pupils must be furnished with abundant thought material, and this is accomplished best by combining language work with observation, number and reading lessons in the primary grades, and later with geography, history and science. If children are induced to think and encouraged to express their thoughts fully and abundantly and in the best available style, they will acquire the habit of using good English. Technical instruction should be given when needed to enable the pupil to express his thoughts adequately. Power to use language is acquired by its use.

The teacher should talk very little, but by careful questioning should induce the pupils to talk freely and thoughtfully and by suggestion and example should lead them to speak correctly. In no subject is more careful preparation required.

At first the work to a great extent must be oral, but as soon as the pupils are able to express their thoughts in writing, the pencil or pen should be an important auxiliary in language work. The teacher should be careful not to assign any more written work than the pupil can do well.

The subjects of the composition work should be interesting to the pupil and should be adapted to his ability. As a rule, written compositions should be upon subjects which have been treated orally. The subjects should be taken mainly from the other studies. All studies can thus be made to provide material for work in language. On the other hand, the regular time assigned to this study does not furnish the only opportunity for language training. Every lesson in every branch of study should contribute to this end.

Power in the use of language arises mainly from the use of connected discourse. Therefore the pupils should be taught as early as possible to use sentences connected in thought. This practice should be continued so that the pupils may acquire the ability to write upon subjects requiring sustained thought. Originality of statement should be encouraged. In grammar grades, in connection with the general exercises, talks and original discussions by the pupils are profitable.

All statements, questions and answers by pupils should be made, as a general rule, in complete sentences. Formal or stilted sentences should, however, be discouraged. The teacher should ask questions or conduct conversations so skillfully that the pupil is required to use complete sentences.

◁PRIMARY DEPARTMENT.▷

LANGUAGE.

FIRST GRADE.

1—Oral work.

- (a) The development of thought from reading lessons, and description of pictures in readers.
- (b) Talks on the human body and personal cleanliness.
- (c) Talks on manners and morals. To be given indirectly through the medium of stories, memory gems, etc.
- (d) Talks on the months.
    1. Position in the year.
    2. Change of seasons.
    3. Natural phenomena.
    4. Holidays.

In this work, which should take the form of familiar conversations, and which should be marked with freedom of expression, the teacher will find abundant opportunity to correct ungrammatical expressions, faulty articulation and pronunciation.

2—TECHNICAL WORK.

- (a) Thinking games.
    1. Name objects of a certain color, shape or those used for certain purposes.

2. Teacher describes object, animal or familiar building.

Children
- 1. Ask questions.
- 2. Arrive at conclusions.
- 3. Give reasons.
- 4. Repeat description.

The teacher should purposely omit some point in order to make the children ask questions.

(b) Action Lessons.

The purpose of these lessons is to lead the children to form correct habits of speech.

Teach use of see, saw, was, were, etc.

An excellent plan for these lessons may be found in "Waymarks for Teachers."

(c) Picture lessons.

Purpose
- To teach the child to observe,
- to think,
- and to reason.

1. Picture described as a whole.

Statements should be complete; bear relation to each other, etc.

Terms used—There are, this is, that is, etc.

Question on principal points for first reproduction—then reproduce without help.

2. As a basis for imaginary story.

Purpose
- Observation.
- Thought.
- Imagination.
- Narration.

Lead children to see every object in the picture in its relation to a central figure.

(d) Object lessons—descriptions, etc.

(e) Lessons on familiar animals.

Their parts, uses, habits and home.

(f) Nature study.

- 1. Fall and Winter.
  - 1. Plants — Parts — simple description.
  - 2. Trees.
  - 3. Grain.
  - 4. Fruits.
  - 5. Nuts.
  - 6. Harvest.
  - 7. Frost.
  - 8. Snow.
- 2. Awakening of Spring.
  - 1. Trees.
  - 2. Twigs and buds.
  - 3. Germination.
  - 4. Flowers.

(g) Hiawatha's childhood.

Building of his canoe; his friends.

3.—Written work. Copying work (two-thirds of term)

(a) Copy sentences from reader, etc.

(b) Teach pupil to write his name and address.

(c) Teach pupil to write name of school.

(d) Teach pupil to write names of the days, months, date.

(e) Lists of words.

(f) Dictation to follow copying; one-third of term.

(g) Original work.

Have children write short sentences containing specified words. All sentences, whether written or oral should be the result of knowledge obtained.

(h) Teach use of capitals, period and question mark.

Teach some of the following poems:

The Little Plant (Plant Baby)	K. L. Brown
The Sparrows	Thaxter
The Sun's Travels	Stevenson
Bird and its Nest	Field
Wynken, Blynken and Nod	Field
Jack Frost (Child's Garden)	[illegible] ~~Stevenson~~
Come, Little Leaves	Eleanor Smith
Night Wind	Field
My Bed is a Boat	Stevenson
Snow Flakes Story (Plant Life)	
Brown Thrush	Larcom

FABLES TO BE TOLD:

Fox and Grapes (self-deceit).
Lion and Mouse (Kindness rewarded).
Dog in the Manger (selfishness).
Wind and Sun (gentleness).

FAIRY STORIES:

Red Riding Hood (obedience to parents).

Cinderella (true worth).
Three Bears (disobedience).
Stories from Greek Myths.

The above named books may be obtained from the Free Public Library.

SECOND GRADE.

LANGUAGE.

1—Oral work.

(a) Continue talks on months, human body, personal cleanliness, morals and manners.

(b) Continue lessons on word-forms.

(c) Picture lessons.

More extended than first grade.

(d) Animals (wild).

(e) Object lessons.

(f) Reproduction stories.

Aesop's fables, short fairy stories.
Stories to be told, not read; to be short and pointed.
The stories should be repeated until absorbed by the children.
Reproduced by children in logical order.

(g) Discussion of simple poems and memory gems.

To be read as wholes; discussed in parts.

(h) Short talks on American History.

(i) Nature study.
  1. Lessons on leaves—parts, etc.
  2. Seed distribution.
  3. Familiar birds—their appearance and habits.
  4. Minerals.

2—Technical.

(a) Use of exclamation point, comma, and possessive form.

(b) Give much attention to copying words and sentences correctly.

(c) Abbreviations; st., ave., etc.

(d) Dictation of simple sentences containing words used in the reading and other lessons.

(e) Sentences containing words specified by teacher.

(f) Action lessons.

Teach some of the following poems:

September	H. H. Jackson
October	H. H. Jackson
Down to Sleep	H. H. Jackson
Seven Times One	Ingelow
The Children's Hour	Longfellow
Good-Bye to Summer	Smith
Golden Rod	Larcom
What the Winds Bring	Ste~~a~~dman
Mountain and Squirrel	Holmes
November	Thaxter ~~Carey~~

In the Black Forest........................Thaxter
Jack in the Pulpit ....Eleanor Smith
Winter Pine ....Stevenson
Sweet and Low ....Tennyson
Song of the Brook ....Tennyson
The Leaflets ....(Plant Baby)
The Crocus ....(Plant Baby)
Talking in Their Sleep ....Edith Thomas
One, Two, Three..................(Stepping Stones)
Little Flax Flower ....M. Howitt

Fables to be told:
Hare and Tortoise ....(Overconfidence)
Dog and Shadow ....
Ant and Grasshopper ....(Improvidence)
The Crow and the Cheese ....(Pride)

Fairy stories:
The Little Match Girl ....Anderson
Pine Tree..............................
Ugly Duckling ....
Story of the Year ....Poulson
The Anxious Leaf ....

Talks should be given on the principal holidays, as Christmas and Thanksgiving, etc. See Kate Douglas Wiggin's "In Story Hour." Many interesting nature stories may be found in the "Child's World." Consult "Waymarks for Teachers," by Miss S. B. Arnold. These books may be obtained from the Free Public Library.

NOTE—One-third of the term should be devoted to copying, one-third to dictation, and one-third to sentence building.

LANGUAGE AND GRAMMAR.

THIRD GRADE.

1—Oral work.

(a) Stories relating to geography, history and nature study.

(b) Poems relating to same.

(c) Memory gems.

(d) Lessons on human body.

(e) Talks on morals and manners.

(f) Picture lessons.

Style of picture more advanced than in previous years. Children to decide in what order objects should be taken for description. Train to select in order of importance. Children to answer orally suggestive questions concerning pictures. Place outlines on board as a guide for oral description. Pictures to refer to historical scenes or places and subjects of interest touched upon in geography and nature study.

(g) Action lessons.

Actions selected should not be difficult to describe. Require pupils to observe closely and describe in full, using only one "and".

2—Written Work. Technical Work.

(a) Punctuation. Review thoroughly the work of preceding years. (1) Exclamation points. (2) Comma used to separate words in series. (3) Use of comma and period in punctuating date and address. (4) Simple use of quotation marks, and comma before undivided quotations.

(b) Capital letters. Review work of preceding years.

(c) After children can spell the words, teach the following abbreviations: (1) The names of the months; (2) Initials in the names of persons; (3) Dr., Rev., Prof., Prin., Supt., etc.

(d) Copying letter; teaching: (1) The heading; (2) The address; (3) Salutation; (4) Close; (5) Superscription of a letter. Only the most common forms to be taught in this year.

(e) Original letters. Only the simple kinds in which the children describe visits to the country, etc.

Reproduction—

(a) Stories told by teachers.
(b) Picture stories.
(c) Reproduction of reading lesson.

This work in every instance must be developed by familiar talks, and should be written from outlines.

Throughout the entire course the teacher should see that her pupils are thoroughly familiar with a subject before she allows them to write about it. Clear expression is always preceded by clear thinking and accurate knowledge.

Sentence building and the use of the elliptical sentence.

DICTATION—

There must be no haphazard dictation work. To be valuable, dictation exercises must be carefully prepared and have a distinct object in view.

FOURTH GRADE.

In the first three grades at least three-fourths of the work is oral. The pupils are now prepared to do more written work. Special attention should be given to the written form of the work as punctuation, the title, margin, indented lines, and capitals. Teach stating, asking and commanding sentences. Direct quotation.

Material for language lessons:—

Reproduction of historical stories.

Reproduction of studies in geography; as How Cotton Grows, The Story of Lumbering; Where We Get Our Sugar, etc.; Imaginary journeys.

Stories from literature.

Object lessons on an apple, a seashell, a silver dollar, a lead pencil, wood, flax, salt, a bunch of grapes, etc. After three or four lessons on objects have been given, lessons on pictures may be given for variety; the lessons on objects may then be resumed and continued through the term or until the pupils are able to write a fairly good story without assistance, when a simple object is put into their hands. Before a lesson is given there must be thorough preparation on the part of the teacher. Object and picture lessons should include five distinct lines of work, as follows:

First day—Lesson given. Teacher writing story in proper form on the board.

Second day—Pupils make a correct copy of the story from the board. After a few lessons have been given and the pupils have become familiar with the written form, they may add anything they would like to say to the teacher's story.

Third day—Reading and oral criticism. Each pupil, standing before the class, reads his own paper. This should be a model exercise in every respect—the position before the class, the bow, the reading, etc. Always require pupils to look over their work, that they may read script as readily as exercises from their readers. The tone of voice and pronunciation also should receive careful attention.

Oral criticism: Have each pupil mention something—at least one point—in each composition, that he thinks especially well done—the reading, the bow, the beginning of the story, the tone of voice, the sentences, some well chosen words or pleasing expression, the way the story was finished; also the language used. Have the pupils mention at least one thing in connection with each story that he thinks could be improved.

Fourth day—Correcting written work. There will be few mistakes while the work is copied from the board, but the points that require attention are the same as in compositions written wholly by the pupils.

(a) Correcting sentences, from the story written on board.

(b) Pupils make the corrections indicated in compositions, misspelled words, capitals, punctuation.

Fifth day—Final copy in composition books.

Morey's Elementary English to page 30 contains suggestive lessons for fourth year's work for the "B" Class; to page 43 for the "A" Class.

FIFTH YEAR.

Materials for language lessons:—

Topics taken from history.

Biographies of heroes.

Accounts of imaginary journeys in connection with geography and history.

Reproductions of stories from literature; fables; from readers.

The animal kingdom.

Directions for reproduction work:—

1. Read the story so as to produce an absorbing interest and perfect attention.

2. The pupils are to give a good oral reproduction from one reading. Try again and again until each can tell a story readily and in good language.

3. Let the pupil reproducing stand before the class.

4. Follow the order of the story.

5. Require an easy, pleasant conversational tone of voice. Morey's Elementary English to page 53 contains suggestive lessons for fifth year's work for the "B" Class; to page 63 for the "A" Class.

SIXTH GRADE.

LANGUAGE.

1—Reproductions from popular tales as "Jack and the Beanstalk," etc.

2—Narratives from pictures.

3—The Mineral Kingdom as clay, sand, coal, granite, silver, lead, copper, iron, tin, etc.

Morey's Language Lessons contain suggestive lessons for this work.

Formal Written Work:—

Metcalf's Elementary English Grammar to page 124 will indicate the scope of the work for the "B" Class; to page 196 for the "A" Class.

SEVENTH GRADE.

LANGUAGE.

NOTE—The pupil has by this time learned the essential features of correct expression by actual use, and has, indirectly, become acquainted with the practical parts of technical grammar, and is now ready to take up the formal study of the subject. If the pupil is thoroughly grounded in the preceding work, he will experience but little difficulty in the study of technical grammar. The pupils are now ready for more formal compositions drawn from history, science, geography, etc. Letter writing should be taught as specified in the various grades.

FOR THE "B" CLASS—

(a) Letter writing—Letters of friendship.

(b) Reproductions of narrative and descriptive poems as Sheridan's Ride, The Battle of Blenheim, etc.

(c) The Vegetable Kingdom—tea, cotton, etc.

FOR THE "A" CLASS—

(a) Letter writing—Business forms as bills, receipts, orders, notes.

(b) The Vegetable Kingdom—coffee, hemp, flax, etc.

(c) Reproductions from heroic deeds as "The Soldier's Reprieve," "John Maynard," etc.

GRAMMAR.

Metcalf's English Grammar, Part 1, to page 55, will indicate the scope of the work for the "B" Class, and to page 87 for the "A" Class.

EIGHTH GRADE.

LANGUAGE.

(a) Reproduction from stories, as Robinson Crusoe; the Legend of Sleepy Hollow, etc.

(b) Biographical Sketches, as Abraham Lincoln, H. W. Longfellow, etc., etc.

(c) Outline prepared for original compositions.

(d) Narratives, descriptions, scenes and experiences.

(e) Letter writing—Social.

GRAMMAR.

Metcalf's English Grammar, Part 2, from page 91 to page 138, will indicate scope of work for the "B" Class; from page 138 to 176 for the "A" Class.

NINTH GRADE.

Call attention to figures of speech and points of rhetorical excellence. Sketches of characters in books, read in connection with history. Reproduction of stories from literature as Evangeline, Vision of Sir Launfal, Miles Standish, Lady of the Lake, etc., etc.

Letter writing—business forms.

GRAMMAR.

Metcalf's English Grammar, Part 3, will indicate the scope of work for the "B" Class; general review of the subject for the "A" Class.

ARITHMETIC.

The chief object of this work is to lead children to form correct concepts of numbers and their relations. The object of all arithmetic teaching has been well said to be three-fold in its character, viz: mental discipline, preparation for more advanced mathematical work, and preparation for business. Dr. Allen says the work of

Primary Arithmetic consists in acquiring a knowledge of numbers, a mathematical vocabulary (written and spoken) and a mastery of the fundamental processes. The work of Intermediate Arithmetic consists in applying these processes to various units and transactions and in solving and explaining problems. The work of Advanced Arithmetic consists in applying these processes to various business practices. In Primary Arithmetic, the teacher should endeavor to secure accuracy, neatness and expertness; in the Intermediate Arithmetic, readiness in solving and explaining examples; and in Advanced Arithmetic a knowledge of business language, forms and practices.

Pupils should not be allowed to learn the rules in Arithmetic until processes and the reasons therefor are understood.

All operations and processes taught should, if possible, be associated and compared with others previously taught, which are based upon the same principles.

Pupils should be trained constantly in problems applicable to the common transactions of every day life. These problems should be carefully prepared. All forms of analysis should be brief. All written work on the board, slate or paper, should be neat in appearance and orderly in arrangement. Pupils should not be allowed to see or present careless or slovenly work. Their work should not be accepted unless it is the best they can do. Accuracy in the use of language whether written or oral should be insisted upon.

All forms and statements should be logically as well as grammatically correct.

In every grade the work of preceding grades should be reviewed. By this is meant, not a formal review, but rather the constant repetition of previous work, which means good teaching.

HINTS FOR THE TEACHING OF NUMBER IN THE FIRST AND SECOND GRADES

All reviews and drills should be short and brisk. They should include a few of the most difficult combinations. Occasionally give an easy combination for the benefit of the dull pupils. The teacher should have a list of the most difficult combinations. By reviewing a few each day the list can be completed in a week. Try to call on every pupil some time during the day. As soon as a table is completed, review thoroughly. In reviewing work for the term, take the most difficult work first.

All work should consist of:

1—Review.
2—New Matter.
3—Drill.

REVIEW:

- 1 Time—ten minutes.
- 2 Matter—difficult combinations.
- 3 Presentation
  - 1 With splints.
  - 2 Orally.
  - 3 Board
    - with elimination
    - without "
- 4 Work must be spirited to be effective.

NEW MATTER
1—Refer to last number learned.
2—How many can tell what to-day's lesson will be?
3—Number of steps needed.
4 With what number do we begin?
5—Each number to be developed.
6—As soon as a number has been developed, call for the reverse and its stories. As 4x2, number developed. 2x4, reverse.

DRILL:
1—Call on two or three dull pupils to read the number.
2—Erase first of second equation; then require pupils to supply erased equation.
3—Board Work—every second example—number developed, or the reverse. As

4x1-|-3x1-|-1x1=8x1
1x2-|-1x2-|-2x2=4x2=8x1
4x1-|-5x1-|-6x1=15x1
1x4-|-1x4=2x4=8x1

CONCRETE:
1—Give three examples embracing new number.
2—Give two containing the most difficult combinations.
3—Let pupils form problems, about ten in all.

SLATE WORK:
1—Writing story of new number.
2—Writing numbers from dictation.
3—Roman numbers.
4—If time permits, a few examples.

BUSY WORK:—Give each pupil a different number and let him write as many stories as possible.

If the number to be developed is a large one, shorten the review or teach half the step, reserving the other half for the next day.

For the teaching of numeration and notation see Allen's Manual, page 17.

In order to secure the best results, the programme should provide twenty minutes for reciting; twenty minutes for studying number in the forenoon; and twenty minutes for reciting in the afternoon, thus assigning to number, one hour per day or five hours a week.

PRIMARY DEPARTMENT.

ARITHMETIC.

FIRST GRADE—"B" CLASS—

1—Numbers and figures to 100.

2—Ordinals to 100th.

3—Table of ones to 24x1.

4—Roman Numerals to L.

5—Table of twos.

6—Multiplication table of twos.

7—Concrete oral problems involving the multiplication table taught.

FIRST GRADE—"A" CLASS—

1—Numbers and figures to 1,000.

2—Ordinals to 1,000th.

3—Tables of 3, 4, 5, 6, to 6x6+6x6=12x6=72x1.

4—Multiplication tables of 3, 4, 5, and 6.

5—Roman Numerals to 100.

6—Concrete problems, involving the multiplication tables taught.

7—Introduction of minus sign (—) in tables as

$7x1-2x1=5x1$

$3x1+4x1-2x1=5x1.$

8—Addition of single columns of figures both oral and written; the pupil to invent his own form of procedure.

9—Simple subtraction, as

$$\begin{array}{r} 846 \\ -221 \\ \hline \end{array}$$

SECOND GRADE—"B" CLASS—

Review Tables of Series I:

1—Numbers and figures to 500,000.

2—Multiplication Tables of 7, 8, 9.

3—Roman Numerals to 5,000.

4—Concrete examples involving linear and liquid measure.

5—Introduce examples like the following:

$5x6+3x4=42x1$

6—Addition examples, (carrying)

7—Advanced Subtraction as

$$\begin{array}{r} 1234 \\ -\ 768 \\ \hline \end{array}$$

Consult Hoose's Second Book, page 196.
Consult Allen's Manual, page 16.

SECOND GRADE—"A" CLASS—

1—Review tables taught.

2—Teach tables 10, 11 and 12.

3—Numbers and figures to 1,000,000.

4—Roman Numerals to 10,000.

5—Concrete examples in addition, subtraction and multiplication; give problems involving the following tables; dry measure, avoirdupois, weight, time and prices of common commodities.

6—Introduce examples like the following:—

$12\times7+\quad\times5=104\times1$

$7\times8-2\times7+8\times6-3\times4=$

7—Teach pupils to read and write dollars and cents as

$4.30, $0.08.

Give examples of this character.

THIRD GRADE—"B" CLASS—

1—Review tables previously taught.

2—Read and write any number of nine figures.

3—Multiply by any number expressed as a digit.

4—Tables of Series Two, as

(a) $1\times1=$ what part of 2?

(b) $1\times1=\frac{1}{3}$ (3)

(c) $1\times1=\frac{1}{4}$ (4)

5—Tables of Series Three.
(a) $\frac{1}{2}$ (2)=how many times 1?
(b) $\frac{1}{3}$ (3)=? x1
(c) $\frac{1}{4}$ (4)=? x1

6—Multiply by any number not having ciphers at the right.

7—Concrete problems in addition, subtraction and multiplication; give problems involving dry, liquid measure, etc. Statements to be written.

THIRD GRADE—"A" CLASS—

1—Review.

2—Multiply by any number.

3—Tables of Series IV. to XIV. inclusive. (To be taught as one series).

4—Teach the law of signs and introduce examples like the following:

$6x8+12\div2x3\div(4+6)=$

5—Begin the work in compound numbers in the common tables.

6—Concrete problems involving addition, subtraction and multipliaction.

7—Series XV.

8—Written multiplication.

For methods of work see Allen's Manual, page 23.

FOURTH GRADE—"B" CLASS—

1—Division tables expressed as follows:

(a) $4\underline{)20}$ (b) $20\div4=5$.

2—Short division.

3—Extend the work of Compound Numbers.

4—Apply the tables to larger numbers, e. g.
Find $\frac{7}{9}$ of 63081.
7501=$\frac{1}{3}$ of how many, etc.

FOURTH GRADE—"A" CLASS—

1—Long division.

(a) When the first figure or two figures of the dividend contain the left hand figure of the divisor the true number of times.

(b) When two trials are necessary to obtain the quotient.

(c) When three trials are necessary to obtain the quotient figure.

(d) When any number of trials may be necessary to obtain the quotient figure.

2—Application of division of concrete examples.

3—Concrete problems involving addition, subtraction, multiplication and division and the application of the Third Year's Tables.

4—Miscellaneous examples based upon the technical terms connected with the fundamental operation.

5—Miscellaneous examples, abstract and concrete.

6—Definitions of the fundamental operations and of the technical terms and principles connected with those operations.

7—Simple problems in area.

FIFTH GRADE—"B" CLASS—

1—Factoring.

2—Greatest Common Factor.

3—Reduction of Fractions.

4—Problems of volume.

5—Least Common Multiple.

6—Cancellation.

FIFTH GRADE—"A" CLASS—

1—Addition and Subtraction of Fractions.

2—Multiplication of fractions.

3—Division of Fractions.

4—Complete Fractions, including Mixed Number and Complex Fractions.

◁GRAMMAR DEPARTMENT.▷

SIXTH GRADE.

"B" CLASS—

1—Decimals.

2—Cost of articles by the 100 and by the 1,000.

3—Reduction of common fractions to decimals and of decimals to common fractions.

4—Bills and receipts, etc.

5—Denominate numbers.

(a) Reduction of

(b) Application of common fractions and decimals to

"A" CLASS—

1—Review "B" Class work.

2.—Applied processes in Compound Denominate Numbers.

3—Miscellaneous examples for drill.

4—Measurements.

Problems in area and volume.

Careful, accurate statements in solving and explaining problems are conducive to clear thinking.

The application of denominate numbers should be made as practical as possible. Require the pupils to take measurements of doors, windows, window-panes, floors, walls, yards, boards, etc., and make examples based upon these measurements.

Spend most time upon tables most in use. Special attention should be given to the analysis of concrete examples.

SEVENTH GRADE.

"B" CLASS—

1—Review preceding grade.

2—Measurements in flooring, plastering, papering, carpeting, etc. Make this work practical by requiring the pupils to take actual measurements of walls, floors, etc. Have them measure rooms at home for carpeting, etc.

3—Problems of PERCENTAGE.

- (a) Careful drill on the following as preliminary work.
    - 1. Finding the fractional part of a number.
    - 2. Finding a number, a fractional part being given.
    - 3. Finding the relation of one number to another.
- (b) The three fundamental "cases", using easy problems.

4—Profit and loss.

- (a) Application of the principles of percentage to profit and loss.
- (b) Simple problems constantly occurring in business.

"A" CLASS—

1—Review of preceding grade.

2—Commission.

- (a) Nature and use of commission fully illustrated.
- (b) Problems to find commission, net proceeds or entire cost only.

3—Fire Insurance.

- (a) Clearly illustrated.
- (b) Problems occurring in real life.

4—Duties.

- (a) The pupils led to have a clear conception of the nature and purpose of duties and customs.

(b) How and by whom levied.

(c) Revenues and tariff.

EIGHTH GRADE.

"B" CLASS—

1—Review preceding grade.

2—Simple interest.

(a) Nature and purpose clearly illustrated.

(b) Practical business methods.

(c) Promissory notes, checks, due bills, and receipts.

(d) Practical examples involving the four "cases."

3—Compound interest.

Easy examples to illustrate the principle.

"A" CLASS—

1—Review.

2—Ratio and proportion.

(a) Ratio, another form of expressing the relation of two numbers.

(b) Equality of ratios.

(c) Easy problems.

NINTH GRADE.

"B" CLASS—

1—Review.

2—Discount.

- (a) Trade.
  The nature and purpose of "trade discounts" clearly illustrated by giving many simple problems.
- (b) Bank discount.
  1. Banks and banking simply illustrated.
  2. Practical experience in discounting notes.
  3. Different forms of notes.
  4. Practical problems.
- (c) True discount.

3—Partnership.

"A" CLASS—

1—General review of arithmetic.

2—Domestic exchange.
- (a) Without time—sight drafts.
- (b) With time—time drafts.
- (c) Comparison of checks, drafts and notes.

3—Square Root.
- (a) Process developed objectively.
- (b) Rule deduced from objective work.
- (c) Problems.

4—Mensuration, illustrating the method of finding the area of a square, rectangular or triangular surface; the diameter, circumference or area of a circle, etc.; volume and surface of a cube, pyramid, cone and sphere.

READING.

"The great purpose is to get the author's thought. That it should be of interest and value is of supreme importance, since our purpose in teaching the child to read is to give access to the best and truest thought, that it may influence his heart and life."

Distinct enunciation and correct pronunciation should be taught in all grades, but they should receive special attention in the primary department. If a pupil's voice is defective it should receive special drill. Loud or sharp tones should be discouraged. Concert work cultivates "school tones," allows the dull or careless pupils to depend on others, gives help to those who should not receive it, and should therefore be avoided. Constant care should be exercised as to the position of pupils while reading.

The reading lesson should lead the pupil to an acquaintance with the classics of our literature. Therefore the study of literary selections should be begun as early as possible. The teacher should aim to impress the pupils with the beauty of the selections read, and thus inspire them with a love for good literature.

As most of the reading in after life must be silent reading, and that, too, at sight, much attention should be given to accurate and rapid work in grasping thought from the printed page. Opportunity should be given frequently for silent reading as well as for reading aloud at sight. The teacher should make use of the Public Library and encourage the pupils to do so. The suggestions of the teacher will have great influence in guiding the home reading of the pupils.

In all grades, beautiful passages in prose and verse should be memorized by the pupils. They should be short in the lowest grades but should not always be limited to extracts. As soon as the pupils can do so, they should memorize entire selections.

No teacher should neglect the careful preparation of the reading lesson.

⊲PRIMARY DEPARTMENT.⊳

READING.

FIRST AND SECOND GRADES.

Teach reading by a combination of the sentence, word and phonic methods. The work should be divided into two parts; the foundation work, which must be thoroughly mastered before the book is placed in the hands of the pupils, and the practical application of the preliminary drill to reading from the book. The foundation work should cover a period of about nine weeks and should include four distinct lines of drill.

1—Drill in phonics.

2—Drill in Stock Words.

3—Drill in Blend Words.

4—Drill in Sentence Building and Sentence Reading.

The four lines of work should be presented in the order named. Experience proves that it is better to have four short periods each day than one long one.

Teach the phonics and stock words in the morning;

the blend words and sentence building and reading during the afternoon.

Throughout the foundation work script characters only should be used. Do not place the book in the hands of the pupils until the foundation work has been thoroughly mastered.

By pleasant conversation, familiarize the children with the words to be taught. When teaching an object-word, present the object if possible; sketch a picture on the board.

All stock words are to be recognized at sight, the same as you would recognize a friend or familiar object.

Teach phonic characters through the medium of stories told in an interesting manner. During the foundation period of this work do not teach the letter-name but the sound-name.

Teach the blend words by means of perception cards.

Present perception card containing the word RAN in the following manner. Place a piece of paper over the "r" and have the "an" sounded, then cover the "an" and have the "r" sounded; finally show the word and have it sounded as a whole.

It has been truly said "That to secure intelligent reading, the child must think intelligently, and then he will have no difficulty in expressing himself intelligently." Present every lesson in an intelligent manner. The reading lessons given in the book for each day's work should be developed story by story, after which a few pupils may be required to read the complete lesson.

Writing and spelling should be correlated with reading. Writing should begin at once by requiring the pupils to copy single words; when sufficient progress has been made, the phrase may be introduced; then the full sentence.

During the foundation period, all spelling should be written; after that oral and written spelling should receive equal attention.

Insist on natural tones, distinct enunciation and correct pronunciation.

READING MATTER—

First Grade: Primer and First Reader, or their equivalents.

Second Grade: Second and Third Readers, or their equivalents.

SUPPLEMENTARY READERS—

Reading by Grade Books I. and II.

READING.

THIRD GRADE.

Third Reader.

All new words in each reading lesson should be carefully studied and the pupils should be encouraged to use them in original sentences. Question pupils as to the meaning of words. Illustrate when possible by objects or pictures. Constant attention given to naturalness of expression. In connection with work in reading, the teacher should often read to the children from standard books, portions that are adapted to children of this grade.

SUGGESTIVE LIST—

Selection from Little People of the Snow, Bryant.
Selection from "Hawthorne's Wonder Book."
Stories from "Nature Myths," F. J. Cook.
Poems from "Sunshine Land," Edith Thomas.
Poems from "A Little Book of Poems," Eugene Field.

SUPPLEMENTARY READERS—

Baldwin's Reading by Grades Book 3.

FOURTH GRADE.

Barnes' Third Reader.

Constant attention to naturalness of expression. Besides regular reading lesson, pupils should have read to them some of the best things in literature for the purpose of forming a taste for good reading.

The following list is suggested:

Longfellow, "The Children," "The Village Blacksmith."
Dicken's "Little Nell."
Selections from Hawthorne's "Wonder Book."
Eugene Field's "Little Book of Profitable Tales."

SUPPLEMENTARY READERS—

Reading by Grades, Book 4.

FIFTH GRADE.

Swinton's Third Reader.

Ability to read well should have been acquired when the pupils leave this grade. Constant attention should be given to correct pronunciation, clear enunciation and naturalness of expression.

The books designed for any grade should not be read by children of other grades.

Suggestive material for occasional use:

Anderson's Stories.
Alcott's Little Men.
Kingsley's Water Babies.
Sewell's Black Beauty.
Century Book for Young Americans.
Eggleston's Young Americans.
Dunton's Our Own Country.

SUPPLEMENTARY READERS—

Reading by Grades Book 5.

GRAMMAR DEPARTMENT.

SIXTH GRADE.

Barnes' Fourth Reader.

The pupils should be led to enjoy what they read and to grow through the acquisition of ideas.

The teacher's chief work here is to inspire the pupil to his best efforts. The following references are given as suggestive material for occasional use. In no case should reading of this kind be done merely to pass away time:

Suggestive material for occasional use:

"Song of Marion's Men," Bryant.
"Old Ironsides," Holmes.
"The American Flag," Drake.

"The Flower of Liberty," Holmes.
"God Save the Flag," Lowell.
Alcott's "Little Women."
"Rip Van Winkle," Irving.
Hawthorne's "Tales of the White Hills."
Ruskin's "King of the Golden River."
"The Mayflower."
Burrough's "Sharp Eyes."
"Robinson Crusoe."
Denton's "Our American Neighbors."
King's "This Continent of Ours."
King's "Rocky Mountains."

SUPPLEMENTARY READERS—

Reading by Grades Book 6.

SEVENTH GRADE.

Swinton's Fourth Reader.

Besides the regular use of the readers, the pupils should read widely from other books for increase of interest and for enriching their vocabulary. The necessary interruptions for the corrections of mistakes and for drill upon the reading matter, of the regular reading lessons, frequently distracts the attention of the pupil from the literary value of what he reads. The pupils should be led to enjoy what they read and to grow through the acquisition of ideas.

The teacher's work here is to inspire the pupil to his best efforts. As opportunity offers, read to pupils and allow one pupil to read to the class from some of the following:

"The Angels of Buena Vista," Whittier.
"The Planting of the Apple Tree," Bryant.
"Song of the Brook," Tennyson.
"Woodman, Spare That Tree," Morris.
"Breathes There A Man," Scott.
"My Country," Montgomery.
Hale's "Man Without a Country."
Dicken's "Christmas Stories."
Scott's "Kenilworth."

EIGHTH GRADE.

Lights to Literature Book 4.

Reading lesson from the reader in this grade should be made the occasion for close drill upon correct delivery as well as the basis for a thorough study of the literature itself.

Whenever possible to find in the Public Library or among pupils, copies, containing the following selections, use them for reading lessons:

"The Last Leaf," Holmes.
"A Forest Hymn," Bryant.
"Snow Bound," Whittier.
Scott's "Ivanhoe."
Irving's "Sketch Book."
Cooper's "Last of the Mohicans."

NINTH GRADE.

Lights to Literature Book 5.

Besides drill reading, the pupils of this grade should read much at sight for the sake of ideas and inspirations

—to learn to love and enjoy good reading. The following references are given in the hope that the teacher or pupil may be able to furnish the book so that some of these selections may be read in the class:

Irving's "The Legend of Sleepy Hollow."
Tennyson's "Enoch Arden."
Lowell's "Vision of Sir Launfal".
Scott's "Lady of the Lake".
Longfellow's "Miles Standish."
"Evangeline".
"Life of Lincoln."
Dicken's "Tale of Two Cities."
Burns' "Tam O'Shanter".
Hughes' "Tom Brown at Rugby."

SPELLING.

Spelling should be taught principally through reading and writing. The eye should be trained to see the word exactly as it is.

As spelling in English is largely dependent upon the memory, first impressions are of the utmost importance. Incorrect spelling may be said to be due chiefly to careless observation. In one sense, every lesson is a language lesson and a spelling lesson. Children should from the first be taught to use the dictionary.

The spelling book is only to be used in the Grammar department. The teacher should supplement it by words selected from the geography, history and other lessons, not found in the spelling book.

PRIMARY GRADE.

FIRST GRADE.

Writing and spelling are co-ordinate subjects with reading and should go hand in hand. All spelling during the first nine or ten weeks should be written; the stock words, blend words, and the reading lessons should constitute the matter for the work. Then oral and written spelling should both be taught, one receiving as much attention as the other. Selected words from reading.

SECOND, THIRD AND FOURTH GRADES.

Note carefully the spelling of words used in written exercises. Select words from reading and other lessons and dictate them in sentences.

Make lists of words difficult to spell, and give frequent practice in writing them and spelling them orally. Occasional oral spelling.

GRAMMAR DEPARTMENT.

SIXTH GRADE—"B".

Gilbert's Studies in Words to page 100.

SIXTH GRADE—"A".

Gilbert's Studies in Words to page 173.

SEVENTH GRADE—"B".

Reed's Word Lessons. Part I.

SEVENTH GRADE—"A".

Reed's Word Lessons. Part 2.

EIGHTH GRADE—"B".

Reed's Word Lessons. Part 3.

EIGHTH GRADE—"A".

Reed's Word Lessons. Part 4.

NINTH GRADE—"B".

The Morse Speller. Parts 1 and 2.

NINTH GRADE—"A".

The Morse Speller. Parts 3 and 4.

PENMANSHIP.

The vertical system is to be used in all the grades of the schools. Much attention is to be given to all writing. Children's writing should be judged, not by what they write in the writing books, but by their ordinary written papers; hence, teachers in all grades are expected to give especial care to the penmanship of all written work and to use the writing books as a means to this end. Reading and writing should go hand in hand, pupils copying from the board the sentences they have read.

No careless nor hasty work should be allowed. The position of the body, feet, arms, fingers, slate, practice paper and copy books, should receive the constant attention of the teacher.

As soon as the forms of the letters are fixed in the minds of the pupils appropriate movement exercises should be regularly given for the purpose of cultivating freedom of movement.

All subjects furnish good opportunities for the use of pen and pencil. These exercises should be written with care until a good, fair hand is acquired.

It often happens that the writing deteriorates, as the amount of written work required in other branches increases. The teacher should give special attention to the writing when this is first noticed.

Legibility, rapidity and uniformity are the ends to be sought.

In the eighth and ninth grades, the work should consist largely of business forms, bills, orders, notes, checks, receipts, telegrams, advertisements, etc., etc.

DURING THE WRITING EXERCISES, NOTHING ELSE SHOULD ENGAGE THE ATTENTION OF THE TEACHER OR OF ANY PUPIL.

DRAWING.

FIRST GRADE—"B" CLASS.

TYPE FORMS—Sphere, cube and cylinder.

Type forms and objects resembling the same to be modeled. Draw pictures of type forms and objects like the type forms similar to type forms.

COLOR—Primary colors (Normal).

TABLETS—Circles, squares and oblongs.

Begin by giving one square, and place in as many positions as possible; then two, three, etc., and arrange in pleasing designs. Treat circles and oblongs in similar manner.

STICK LAYING—Give sticks of equal length.

Begin by giving two sticks; then three, four, etc. Arrange so as to form parallel lines, right angles, acute angles, obtuse angles; then triangles and squares.

PAPER FOLDING AND PAPER CUTTING—Teach value of one to four inches, proper position and proper pencil-holding.

FIRST GRADE—"A" CLASS.

TYPE FORMS—Square prism, right-angled triangular prism, hemisphere.

Draw pictures of type forms and objects like the type forms. Secondary colors (Normal).

TABLETS—Squares, circles and semi-circles, right-angled triangles.

Arrangement of tablets in a row to form borders and arrangement around the center to form rosettes.

STICK LAYING—Sticks of uniform length.

Form right, acute and obtuse angles; geometric and pleasing forms; original designs.

Paper folding and paper cutting.

SECOND GRADE—"B" CLASS.

TYPE FORMS—Review models of first year. Ellipsoid, ovoid, equilateral triangular prism.

Picture drawing of type forms and objects resembling the same.

Tints of Primary Colors.

TABLETS—Ellipses, ovals, equilateral triangles. Make designs for borders.

Draw flowers and leaves.

Paper folding and paper cutting.

SECOND GRADE—"A" CLASS.

TYPE FORMS—Cone, square pyramid, vase form.

Picture drawing type forms and objects like them.

Tints of Secondary Colors.

Paper cutting and drawing.

Make patterns of equi. lat. tri. prism, cube, square pyramid.

Elementary design.

Draw flowers and leaves.

Teach measurement by use of sticks from one to six inches.

Bi-section and tri-section.

Drawing from the pose.

THIRD GRADE—"B" CLASS.

Review type forms of First and Second Years.

Spectrum Colors.

Make designs for surface coverings.

Make patterns of cube, cylinder, and sq. prism and rt. angle tri. prism.

Draw type forms and objects resembling the same.

Drawing from the pose.

THIRD GRADE—"A" CLASS.

Review type forms.

Secondary colors and pigments used to make them.

Draw flower and leaf forms from Nature and conventionalize the same.

Division of space beginning with plaids, differences in space division in plaids are to be observed and drawn.

Original designs of plaids to be drawn.

Drawing from the pose.

FOURTH GRADE—"B" CLASS.

Review type forms. Draw singly and in simple groups.

Intermediate colors. Teach division of space in plaids and scenery.

Patterns of type forms; square prism, cube, plinth, etc.

Draw from Nature and from objects in common use.

Drawing from the pose.

FOURTH GRADE—"A" CLASS.

Review type forms.

Review tints and teach shades.

Draw flower and leaf forms. Conventionalize.

Make drawings of fruit, etc.

Simple working drawing of models.

Drawing from the pose.

Drawing of buildings and part of buildings that resemble the type forms.

FIFTH GRADE—"A" AND "B" CLASSES.

Working drawings of square and circular plinth and triangular prisms.

Pattern making of same objects.

Pictorial drawing of circular objects in front of and below the level of the eye.

Studies from Nature.

Tertiary Colors.

Decoration: Historical ornament, rosette forms, conventionalizing leaf and flower forms. Simple designs to fill squares, equilateral triangles.

SIXTH GRADE—"A" AND "B" CLASSES.

Pattern making of triangular prism, pyramid and working drawing of models already made.

OBJECT DRAWING—The type solid, circular and rectangular.

Simple forms based on the same.

Representation of flowers and leaves and conventionalizing the same.

Draw from the pose.

Historical ornament—Egyptian and Grecian.

Original design around the center and border.

SEVENTH AND EIGHTH GRADES—"A" AND "B" CLASSES.

Historical Ornament—Fleur-de-lis, lotus border, Greek Anthemion. Greek borders and rosettes.

Draw a spray of flowers and leaves.

Mechanical drawing—Geometrical problems.

Working drawing of hexagonl prism and simple joints.

Original designs of surface designs.

NINTH GRADE.

Mechanical drawing.

Geometrical problems.

Solids with sectional views, also of joints and familiar objects.

Object drawing of cylindrical and rectangular objects arranged in groups.

Original designs of surface covering.

Historical ornament: Grecian and Roman.

PHYSIOLOGY AND HYGIENE.

Simple oral lessons in the primary grades, and in the grammar grades written exercises in connection with language work tending to the proper care of the body. This study should not be analytical, nor should it dwell upon possible diseases, tending to produce a morbid state of mind in the children, but it should hold before them, as a model, the healthy human body as the home of the healthy human soul, and should lead to such wholesome care regarding personal habits as the needs of the body require.

PRIMARY DEPARTMENT.

FIRST GRADE.

Personal cleanliness.

SECOND GRADE.

The same as the First Grade, and in addition some attention to characteristics and uses of the more prominent organs of the body.

THIRD GRADE.

As in the Second Grade: special attention being given to cleanliness of the teeth and to the cigarette and candy habits.

FOURTH GRADE.

Simple rules for exercise, rest, sleep, eating, care of the eyes.

FIFTH GRADE—"B" CLASS.

Organs and processes of digestion, simply treated, with the effects of stimulants and smoking thereon, especially among children.

FIFTH GRADE—"A" CLASS.

FOODS—Necessity, kinds, quantity, cooking, chewing, etc.

◁GRAMMAR DEPARTMENT.▷

SIXTH GRADE—"B" CLASS.

Absorption and circulation.

SIXTH GRADE—"A" CLASS.

Respiration and Perspiration.

SEVENTH GRADE—"B" CLASS.

SKELETON—Structure, uses, hygiene, growth, repair.

SEVENTH GRADE—"A" CLASS.

MUSCULAR SYSTEM—Structure, uses, hygiene, growth, exercise.

EIGHTH GRADE—"B" CLASS.

The general nervous system—hygiene, growth, exercise.

EIGHTH GRADE—"A" CLASS.

SPECIAL SENSES—Sight, smell, taste, hearing, touch.

NINTH GRADE—"A" AND "B" CLASSES.

General review of the subject.

Throughout the grades such attention to the uses of stimulants and narcotics as is required by law should be given. The main aim of the work should be positive rather than negative—the securing of good habits through intelligent interest.

GERMAN.

SIXTH GRADE—"A" AND "B".

READING—The Alphabet, both printed and script, with exercises in reading and writing. Found in the first half of Primer.

COLLOQUIAL EXERCISES ON COMMON TOPICS—Home, School, Class.

TRANSLATION—Chiefly oral, from English into German, of simple sentences, including examples under the rules of the grade.

WRITING—Capitals and small letters from a copy.

GRAMMAR—Simple sentences, teach noun, def. art., indefinite art.

SELECTIONS—Three simple selections during the year.

MISCELLANEOUS—Teach cardinal numbers to 100, also names of months, days and seasons of the year.

SEVENTH GRADE—"A" AND "B".

Review work of sixth grade.

READING—Exercises as found in the second half of the Primer.

COLLOQUIAL EXERCISES—As begun in Sixth grade, on Common Topics, Home, School, Class, Body, Lesson, Play.

TRANSLATION—Chiefly oral, from English into German, of simple sentences.

GRAMMAR—Simple sentences, teach noun, def. art. and indef. art., simple adj., per. pronouns, verbs.

WRITING—Pupils to copy from book, capitals, small letters, words, sentences.

MISCELLANEOUS—Four selections, also names of months, days, seasons, cardinal numbers to 300.

EIGHTH GRADE—"A" AND "B".

READING—Exercises from a First Reader with explanations of subject matter and conversation exercises with and without book.

TRANSLATION—Pupils to be able to translate orally reading matter, also exercises according to Ahn's First Book, completed.

COLLOQUIAL exercises continued.

GRAMMAR—Review work of preceding grade, singular and plural of nouns learned, present tense of regular verbs, also of "sein" and "haben', the personal pronouns and all possessive pronouns.

DICTATION—Taken from reading exercises in Reader.

Writing continued.

SELECTIONS—Six to be memorized, together with ten familiar quotations.

NINTH GRADE—"A" AND "B".

READING—From the Second Reader, with exercises on the subject matter, with and without book.

GRAMMAR—Declension of the definite art., and words like the definite article. Declension of nouns complete, conjugation, present, past, future tenses of reg. and irreg. verbs. Comparison of adjectives. Prepositions that govern two cases. The Accusative and Dative.

TRANSLATION—Scholars to be able to translate orally what they have read, also translation exercises according to Ahn's second course to page 86.

SELECTIONS—Six new selections to be memorized and recited intelligently, and ten familiar quotations.

DICTATION—Continued as begun in preceding grade.

PHYSICAL CULTURE.

In the primary department there should be a recess of fifteen minutes near the middle of the morning session, during which the pupils should be allowed to exercise freely in the yards and courts.

In the primary department in the afternoon and in the grammar department in both forenoon and afternoon there should be a recess of five minutes, during which systematic exercises adapted to the physical development of the pupil should be held. During all recesses, the rooms should be ventilated.

MANUAL TRAINING.

The course of instruction in Manual Training in the Public Schools shall comprise the following branches:

Carpentry, Wood Carving and Clay Modeling for Boys.

Sewing and Domestic Economy for Girls.

The schools shall receive instruction in the following order:

School No. 1, Tuesday.
School No. 2, Monday.
School No. 3, Wednesday.
School No. 6, Thursday.

COOKING.

1—Definition.
2—Purposes.

3—Processes.

4—Incidentals and general information respecting materials, source, processes of preparing and combination, care and selection of materials.

PROCESS.
- 1—Boiling.
- 2—Stewing.
- 3—Broiling.
- 4—Baking.
- 5—Frying.
- 6—Preserving.

DEFINITION—

BOILING
- Materials
  - meats
    - fresh
    - cured
    - soup
  - vegetables
    - tubers
    - bulb
    - stems
    - leaves
    - fruits
      - small
      - large
  - doughs
    - dumplings
    - rolly polly
    - puddings
- tepid
- simmering
- boiling
- Liquids
  - beaverages
    - coffee
    - tea
    - cocoa
  - custards
  - sauces
- Utensils
  - tin
  - copper
  - earthen
  - iron
    - plain
    - galvanized
    - tinned

DEFINITION—

STEWING.
- Materials
  - meats
  - vegetables
  - fruits
- Kinds
  - haricot
  - ragout
  - salmi
  - fricasse
  - pot-pie
  - braising

DEFINITION—

BROILING.
- Materials
  - steaks
    - sirloin
    - tenderloin
    - porter-house
    - flank round
  - chops
  - fish
  - oysters
  - clams
  - bread
- Utensils
  - gridiron
  - broiler
  - spit
  - toaster

DEFINITION—

BAKING—Materials
- bread raised by yeast
- bread raised by baking powders with chemistry tests
- meat
  - beef, mutton
  - pork, fish, poultry
- cake (loaf, small)
- pies
- puddings
- vegetables

DEFINITION—

FRYING.
- Materials
  - fish
  - oysters
  - poultry
  - batters
    - thick
    - thin
  - cakes
- Utensils (kettle-pan

PRESERVING—Kinds
- by sugar (fruits)
- by vinegar(fruits, vegetables)
- by salt, smoke, ice (meats)

Marketing for divisions or cuts of meats.

LAYING OF TABLE
- Breakfast
- Lunch
- Dinner

Menues for same.

SEWING.

SIXTH GRADE.

1—DRILLS.

Threading needles, use of thimbles and scissors, position of hands, etc.

Stitches to be taught are Running, Stitching, Overhanding.

Two Runs and a Backstitch.

Felling and French seam.

First practice the stitches on unbleached muslin. Model for each stitch. Applied stitches: Bags, doll sheets and pillow cases.

SEVENTH GRADE.

Review of previous year's work.

Gussets, Flaps and Flies, Gathering and Stroking, Tucking, Buttonholes, Applied Stitches: Doll's clothing.

EIGHTH GRADE.

Review of stitches. Lessons in cutting. Patching on cotton, Darning on stockings and cashmere, Whipped Hem, Slip Stitching, Herringbone, Featherstitching, Drawn Work, Embroidery on linen and flannel.

Applied work—Making aprons, handkerchiefs, skirts, etc.

JOINERY.

EIGHTH GRADE.

1—Chisel practice.

2—Planing, sharpening and setting tool.

3—Making an edge square and true.

4—Making to a required size.

5—Making blocks octagon, round and tapering.

6—Making Lap Joints, the end dovetailed mitre and cross laps.

7—Making Mortise Joints, the slip through blind and relished mortise.

DRAWING.

EIGHTH GRADE.

1—Geometrical figures (three sheets six problems each) and simple working drawings for bench work.

JOINERY.

NINTH GRADE.

1—Keyed Mortise. Brace Joint, Dovetailed box, Parquetry, etc.

TURNING.

1—Cylinders, shoulder cutting, beading and moulding. Face plate work, rosettes, corner blocks, cups, bowls, rings and simple patterns.

DRAWING.

NINTH GRADE.

Geometrical figures and working drawings for Turning and bench work.

MANUAL TRAINING.

WOOD CARVING.

SEVENTH GRADE.

1—Use of chisels and gouges; how to sharpen and whet them.

2—Outlining simple Greek borders and rosettes in low relief.

3—Use of veiners, incising patterns.

4—Simple exercises in concave modeling.

5—Convex modeling, simple patterns.

EIGHTH GRADE.

1—Exercises in convex modeling, gradually increasing in difficulty.

2—Concave and convex modeling applied to useful and ornamental articles, such as blotters, frames, book covers, plant stands and tabourets.

DRAWING.

SEVENTH AND EIGHTH GRADES.

1—Historic ornament.

- (a) Fleur-de-lis.
- (b) Lotus border.
- (c) Greek Anthemion.
- (d) Greek borders and rosettes.
- (e) Simple flowers and leaf forms.

Review, sphere, cylinder and cube. (Blackboard work.) Make patterns of cube and cylinder, and cut them out. Make working drawing of all three models.

GROUP DRAWING.

Draw a group composed of a tumbler, ball and inkstand.

Review hemisphere and square prism. (Blackboard work.)

GROUP DRAWING.

Objects based on square prism and hemisphere.

MODELING.

SIXTH GRADE.

1—Model the geometric solids in the round, beginning with the sphere; then the cube, cylinder, square prism, triangular prisms, ellipsoid, ovoid, pyramid, cone, etc.

2—Study objects resembling type forms, both natural and manufactured objects.

3—Model geometric forms in relief.

4—Model leaf and flower forms—natural and conventional, in relief.

5—Model from Nature and plaster casts.

6—Model examples of historic ornament.

DRAWING.

SIXTH GRADE.

1—Construction drawings; freehand. Pattern making and working drawings of cone, square pyramid, turned; square plinth, turned; tumbler, cylinder, square prism, etc.

2—Representation. Circular objects, angular objects turned, plant life.

3—Decoration. Historic ornament; original designs to fill geometric forms, as square, triangle, pentagon, hexagon and octagon. Exercises in paper folding and cutting and pasting.

MORALS AND MANNERS.

The best interests of society demand moral training as well as intellectual and physical. School life and instruction should develop high character and good citizenship, and whatever assists in this work should have a prominent place in the school curriculum.

The example of the teacher and his unconscious influence are potent but not sufficient factors in moral training. Pupils must know the right that they may be led to feel its claims and will to do it. The teacher can well afford to give time and effort to enforcing those truths that tend to develop true manhood and womanhood.

Morals and manners may be taught as occasion offers, if the teacher be sure to use the occasion with profit when it does occur. The lesson may consist of a short but impressive talk, with illustrations drawn from the school-room and play-grounds, from the relations of pupils to one another, or to their parents and teachers. The teacher should, however, not always wait for the occasion to arise. Short lessons inculcating proper behavior may be given as part of the opening exercises, or at stated times. These lessons should be given in the form of incidents read or told by the teacher. Incidents which illustrate proper behavior should be preferred.

Pupils should be taught to be polite under all circumstances at school, at home, and in all public places; to be obedient to those in authority; law abiding citizens; to be true in look, in word, in deed; to be pure in thought, in speech, in act; to be temperate in all things; to be manly, unselfish, kind, generous, respectful; and to be industrious, self-reliant, economical, orderly.

Advantage should be taken of the lessons in history and of all school celebrations to inculcate patriotism. Patriotic songs should be taught.

In connection with language and reading, the demoralizing effects of bad literature should be specially guarded against. If the good, the true and the beautiful are made attractive to children, there will be few faults and bad habits to be corrected.

DISCIPLINE AND GOVERNMENT.

If by example and precept pupils are effectively taught good morals and manners, the question of discipline will in a large measure solve itself. Next to home, the school should be to the children the pleasantest place in the world. There should be no fretting, scolding nor threatening by the teacher. "As is the teacher, so is the school." In regard to corporal punishment, the State law reads: "No teacher shall be permitted to inflict corporal punishment upon any child in any school in this State," and the State Superintendent rules that this applies to Principals as well as assistant teachers.

Books for Use of Teachers and Pupils.

The following lists of books, that have been selected with great care, will prove of very great advantage to both teacher and pupil in the preparation of work in Geography, History, Nature Work and Literature.

All of the books may be obtained from the FREE PUBLIC LIBRARY. When applying for a book it is not necessary to give the title and name of the author, but use the library number instead. The Reference department of the Free Public Library is replete with works of valuable information.

The Trustees of the Free Public Library have furnished and set apart a large, well equipped reference room for the exclusive use of the teachers and pupils of the Public Schools.

In return for this great privilege, it is to be hoped that the teachers will show their appreciation by urging and encouraging their pupils to liberally patronize this department.

One of the most important duties devolving upon the schools is to encourage among the children the habit of reading good wholesome literature.

An attendant will be in charge of this room who will be pleased to assist teachers in every effort made to help the children in this important matter of reading.

REFERENCE BOOKS FOR TEACHERS AND GRADUATING PUPILS.

Commencement Parts (Model valedictories, salutatories, essays, orations).
Gordy's New Psychology.
Henry—High School Question Book and Answers.
Mistakes in Teaching—How to correct them.
New Dialogues and Plays.
New Letter Writer (Social and Business).
One Thousand Composition Subjects.
Three-Minute Declamations for College Men.
Three-Minute Readings for College Girls.

KINDERGARTEN WORK.

Blow—Symbolic Education	372.2 B62
Calkins—Primary Object Lessons	372.2 C42
Compayre—Intellectual and Moral Development of Children	372.2 C73
Froebel—Mottoes and Commentaries	372.2 F92
Froebel—Pedagogics of the Kindergarten	372.2 F921
Froebel—Songs and Music of Mother Play	372.2F9211
Harrison—Study of Child Nature	372 H24
Mann and Peabody—Moral Culture of Infancy and Kindergarten Guide	372.2 P31
Perez—First Three Years of Childhood	372.2 P41
Poulsson—In the Child World	372.2 P96
Welsh—Object Lessons Prepared for Teachers	372.2W44
Weltse—Kindergarten Stories and Morning Talks	372.2 W71

Wiggins—Froebel's Gifts	372.2 W632
Wiggins—Froebel's Occupations	372.2 W63
Wiggins—Kindergarten Principles and Practice	372.2 W631
Wiggins and Smith—Story Hour	372.2 W633

PHYSICAL CULTURE.

Blackie—On Self Culture	374 B56
Blaikie—How to Get Strong and How to Stay So	613 B57
Blaikie—Sound Bodies for Boys and Girls	613 B571
Checkley—Natural Method of Physical Training	613 C41
Jenness—Comprehensive System of Physical Culture	371.73 J42
Mann—School Recreation and School Amusements	790 M31
Morris—Physical Education in the Public Schools	371.7 M83
Posse—Swedish System of Educational Gymnastics	371.73 P84
Rasmussen—Physical Culture for Public Schools	371.73 R18

HYGIENE.

Call—Power Through Repose	613 C13
Clarke—Building of a Brain	613 C55
Guernsey and Davies—Health at Home	613 G93
Hutchison—Treatise on Physiology and Hygiene	612 H97
McCarthy—Health, Happiness, and Longevity	613M12
Smith—Primer of Physiology and Hygiene	613 Sm5

FOR GENERAL HISTORICAL AND GEOGRAPHICAL READING.

Batty—Spirit and Influence of Chivalry	394.7 B52
Brooks—Chivalric Days	J904 B79
Bulfinch—Age of Chivalry	291 B87
Church—Beginning of the Middle Ages	904.1 C47
Digby—Broadstone of Honour	394.7 D54
Duruy—History of the Middle Ages	940.1 D93
Douglas—Heroes of the Crusades	920 D74
Fiske—Civil Government in the United States	320 F54
Hallam—View of the State of Europe during the Middle Ages	940.1 H15
Hervey—Eric the Archer	j H 44
Hitchcock—American State Constitutions	342 H52
Irving—Knickerbocker History of New York	817 Ir8
Kinderslay—Heroes of Chivalry	398 K57
Mitchell—Hugh Wynne	M6932
Nordhoff—Politics for Young Americans	j320 N75
Reade—Cloister and the Hearth	R2223
Stowe—Uncle Tom's Cabin	St. 739
Whitman—Imperial Germany	943 W93
Yonge—Lances of Lynwood	Yo 822
Winfield—History of the County of Hudson, N. J.	002 W72

GEOGRAPHY, GEOGRAPHICAL READERS AND BOOKS OF TRAVEL.

Andrews—Seven Little Sisters	J An 2212
Ballou—Footprints of Travel	910 B21
Bisland—Flying Trip Around the World	910 B54

Bradley's—Atlas of the World	R912 B72
Brassy—Voyage of the Sunbeam	910 B73
Coffin—Our New Way Round the World, (Reader)	910 C65
Brooks—Mediterranean Trip	910.4 B79
Dawson—Isles of the Sea, (Reader)	910.4 D32
Duncan—Social Departure, (Reader)	210 D91
Goldsmith—Geographical View of the World, (Reader)	910 G57
Guyot—Earth and Man	551 G99
Hathaway—1001 Questions and Answers on Geography	910.7 H28
Jackson—Glimpses of Three Coasts	910 J13
Jones—Famous Explorers and Adventures in Africa	910.8 J73
Lowell—Fireside Travels, (Reader)	910 L95
Maury—Manual of Geography	910 M44
Montefiore—Leaders Into Unknown Lands	910.8 M76
Morris—Half Hours of Travel at Home and Abroad	910 M83
Parker, F. W.—How to Study Geography	372 P22
Prime—Around the World	910 P93
Rand & McNally's—Atlas of the World	R912 R
Rapelje—Narrative of Excursions, Voyages and Travels	910.8 R18
Rupert—Geographical Reader	910 R37
Stables, G.—O'er Many Lands and Seas	J910 St1
Stephens, C. A.—Knockabout Club along Shore	j910.4 St4
Stevenson—Deep Water Voyage	910.4 St3
Towle—Marco Polo	j B P76

Towle—Voyages and Adventures of Vasco da Gama
....J910 T6511
Twain—Following the Equator...........910.4 C59
World, Its Cities and People.......908 W89

AFRICA.

Biglow—Whiteman's Africa 916.7 B48
Kingston—Great African Travelers 910 K61
Knox—Boy Travelers in Egypt J916.2 K77
Knox—Boy Travelers on the Congo......J916.7 K77
Knox, T. W.—Boy Travelers Through Africa J916 K77
Livingston—Travels in Africa............916.7 L76
Ober—Knockabout Club in North Africa..j916.1 Ob2
Stanley—The Congo 916.7 St2
Stanley—South Africa 916.7 St2112
Stanley, H. M.—Through the Dark Continent...
....916.7 St2111
Vincent—Actual Africa 916 V74

ASIA.

Barnaby—Ride to Khiva 915.8 B93
Bickersetth—Japan As We Saw It.........915.2 B47
Bird—Golden Chersonese 915.9 B54
Bird—Unbeaten Tracks in Japan.........915.2 B54
Brassy—Sunshine and Storm in the East.....914 B73
Brassy—Voyage in the Sunbeam...........910 B73
Butterworth, H.—Zigzag Journey in India.J915.4 B97
Butterworth, H.—Zigzag Journey in Australia...
....J919.4 B98
Butterworth, H.—Zigzag Journey in the Antipodes
....J915 B98

Butterworth, H.—Zigzag Journeys in the Levant.. ....J915.6 B97

Champney, E.—Three Vassar Girls in the Holy Land J913.3 C35

Clark—From Hong Kong to the Himalayas..915 C55

Field—Corner of Cathay 915.1 F45

Field—From Egypt to Japan 915 F45

Fogg—Arabistal, or Land of the Arabian Nights.. ....915 F68

French, H. W.—Our Boys in China........915.1 F89

French, H. W.—Our Boys in India........915.4 F89

Greey—Wonderful City of Tokio.......J915.2 G861

Greey—Young Americans in Japan....J915.2 G8611

Holcome—Real Chinaman 915.1 H69

Kenna—Tent Life in Siberia.............915.7 K33

Knox—Boy Travelers in Australasia J919 K77

Knox, T. W.—Boy Travelers in Ceylon and India J915.4 K77

Knox, T. W.—Boy Travelers in Egypt and the Holy Land J916.2 K77

Knox—Boy Travelers in Japan and China.J915.2 K77

Knox, T. W.—Boy Travelers in Siam and Java.. ....J915.9 K77

Knox, T. W.—Boy Travelers in the Far East..... ....J915.2 K77

La Forge—Artist Letters from Japan......915.2 L13

Martin—Cycle of Cathay................915.1 M36

Murray—Story of Japan 952 M96

Palmer—Golden Dragon...............915.92 P18

Parson—Notes on Japan 915.2 P25

Ralph—Alone in China 915.1 R13

T. T. T.—Life in China	915 T11
Taylor—Visit to India, China and Japan	915 T21
Thomson—Land and the Book	915.6 T37
Tomes—Americans in Japan	915 T52
Vincent—Land of the White Elephant	915 V74
Warner, C. D.—In the Levant	915.6 W24

EUROPE.

Abbott—Rollo's Travels	J914.21 Ab2
Brownell—French Traits	914.4 B81
Butterworth—Zigzag Journey Around the World	j910.4 B981
Butterworth—Zigzag Journeys in British Isles	J914.2 B98
Butterworth, H.—Zigzag Journeys in Classic Lands	J914 B791
Butterworth, H.—Zigzag Journeys in Europe	J914B97
Butterworth, H.—Zigzag Journeys in Northern Lands	J914 B9712
Butterworth, H.—Zigzag Journeys in the Orient	j914.78 B98
Butterworth, H.—Zigzag Journeys on the Mediterranean	j910.4 B98
Champney, E.—Three Vassar Girls Abroad	J914 C352
Champney, E.—Three Vassar Girls in England	J914.2 C35
Champney, E.—Three Vassar Girls in France	j914.4 C351
Champney, E.—Three Vassar Girls in Italy	J914.5 C35
Champney, E.—Three Vassar Girls in Russia and Turkey	J914.7 C35

Champney, E.—Three Vassar Girls in Switzerland j914.94 C35

Champney, E.—Three Vassar Girls in the Tyrol J914.36 C35

Champney, E.—Three Vassar Girls on the Rhine J914.3 C35

Champney, E.—Witch Winnie in Holland.j914.92 C35

Cox—Buckeye Abroad 914 C83

Dodge—Hans Brinker ....J D 6621

Du Chaillu—Land of the Midnight Sun ...914.8 D85

Duncan—American Girl in London........914 D36

Field—Old Spain and New Spain........914.6 F451

French—Our Boys in Ireland..........J914.15 F89

Hale—Seven Spanish Cities 914.6 H13

Hall, C. W.—Drifting Round the World...j914 H14

Hapgood—Russian Rambles 914.7 H21

Hawers—Travel and Talk 904 H31

Knox—Boy Travelers in Central Europe..J914 K771

Knox—Boy Travelers in Gt. Britain and Ireland j914.2 K77

Knox, T. W.—Boy Travelers in Northern Europe J914 K77

Knox—Boy Travelers in the Russian Empire.... ....J914.7 K77

Logan—In Joyful Russia 914.7 L82

Lubbock—Scenery in Switzerland 914.94 L96

Luffman—Vagabond in Spain 914.6 L96

MacGregor—Rob Roy on the Jordan 914.8 M71

Marsden—On Sledge and Horseback 914.7 M35

Moulton—Lazy Tours in Spain 914.6 M86

Norman—Girl in the Karpathians.......914.36 N78

Ober, F. A.—Knockabout Club in Spain	j914.5 Ob2
Ramsay—Impressions of Turkey	914.96 R14
Scudder—The Bodley Stories	J Scu416
Smith—Gondola Days	914.5 Sm5
Smith—Well Worn Roads	914 Sm5
Stevenson—An Inland Voyage	914.93 St4
Stevenson—Travels With a Donkey	914.4 St4
Stockton—Roundabout Rambles	J ST623
Thomson—Outgoing Turk	914.96 T84
Twain—Innocents Abroad	914 C59
Vandam—My Paris Note Book	914.4 V47
Wallace—Englishman in Paris	914.4 W15

NORTH AMERICA.

Bird—Lady's Life in the Rocky Mountains	917.8 B54
Butterworth—Boston	J917.3 B97
Butterworth—Zigzag Journeys in Acadia and New France	j917.1 B97
Butterworth—Zigzag Journeys in the Occident	J917.3 B97
Butterworth—Zigzag Journeys in the Sunny South	J917.5 B97
Butterworth—Zigzag Journeys in the White City	J917.73 B97
Butterworth—Zigzag Journeys on the Mississippi	J917.7 B98
Champney—Three Vassar Girls at Home	J917.3 C35
Coffin—Boys of '61	J973.7 C65
Coffin—Boys of '76	J973.3 C65
Coffin—Building of a Nation	J973 C65
Davis—Cuba in War Times	917.29 D29

Davis—View from a Car Window........917.6 D29
Drake—Nooks and Corners of New England.917.4 D78
Field—From the Lakes of Killarney to the Golden Horn 914 F45
Field—Our Western Archipelago.........917.8 F45
Glazier—Down the Great River..........917.7 G46
Hough—Story of the Cowboy............917.8 H81
Ingersoll—Crest of Continent.............917.8 In4
Ingersoll—Knocking Round the Rockies...917.8 In 41
Irving—Astoria 917.9 Ir81
Jackson—Bits of Travel 917.3 J12
Kingsley—Christmas in the West Indies...917.29 K61
Knox, T. W.—Boy Travelers in Mexico....917.2 K77
Lummis—Awakening of a Nation, Mexico of Today 917.2 L97
Lummis—Some Strange Corners of Our Country 917.6 L97
Ober—Knockabout Club in the Antilles...j917.29 Ob2
Ober—Knockabout Club in the Everglades.j917.5 Ob2
Ober—Knockabout Club on the Spanish Main... ....j917.2 Ob21
Parkman—Oregon Trail 917.8 P23
Ralph—Dixie 917.5 R13
Rogers—Mexico ....917.25 R 63
Schwatka—Along Alaska's Great River....917.9 Sch9
Schwatka—Nimrods of the North.........J919 Sch9
Scudder—The Bodley Stories ....J Scu41
Scudder—Boston Town J917.44 Scu41
Sessions—From Yellowstone Park to Alaska.917.89 Se7
Smith—White Umbrella in Mexico.......917.2 Sm5
Stephens—Knockabout Club in the Tropics.J917.2 St4

PACIFIC ISLANDS.

Mather—One Summer in Hawaii	919 M42
Ballou—Under the Southern Cross	919.4 B21
Cumming—At Home in Fiji	919.61 C91
Fiske—Story of the Philippines	919.14 F54
Fraser--In Stevenson's Samoa	919.6 F86
Gironiers—Twenty Years in the Philippines	919.14G44
Hathon—North Borneo	919.11 H28
Jenkins—Voyage of the U. S. Exploring Squadron	919 J41
Lee—Adventures in Australia	919.4 L51
Marjoribanks—Travels in New South Wales	919.44 M33
Stevens—Yesterdays in the Philippines	919.14 St4
Stevenson—The South Seas	919.6 St4

SOUTH AMERICA.

Bishops—Thousand Miles' Walk	918 B54
Butterworth, H.—Over the Andes	J918 B97
Champney, E.—Three Vassar Girls in South America	J918 C35
Dixie—Across Patagonia	918.2 D64
Ewbank—Life in Brazil	918.1 Ew1
Knox, T. W.—Boy Travelers in South America	J918 K77
Orton—Andes and the Amazon	918 Or8
Robertson—Four Years in Paraguay	918.9 R54
Whymper—Travels Amongst the Andes of the Amazon	918 W65

ARCTIC REGIONS.

Blake—Arctic Experiences	919.8 B58
Douglas—Across Greenland's Ice Field	918.8 D74
Greely—Handbook of Arctic Discovery	919.8 G811
Greely—Three Years of Artcic Service	919.8 G81
Hayes—Open Polar Sea	919.8 H83
Kane—Arctic Exploration	919.8 K13
Lachambre & Machuron—Andree's Balloon Experiments	919.8 L11
Nansen—Farthest North	919.8 N15
Peary—My Arctic Journal	919.8 P31
Peary—Northward Over the "Great Ice"	919.8 P32
Schley—Rescue of Greely	919.8 Sch2
Wright—Greenland Ice Fields	919.8 W93

HISTORY OF THE UNITED STATES.

The following books may be had at the Free Public Library. The letter "J" preceding the "Library No." indicates that the book is suitable for young readers, the others will be of advantage to Teachers and advanced pupils.

GENERAL.

Burgess—Middle Period	973.6 B91
Cable—Silent South	973.8 C11
Chambers—Higher History of the U. S.	973 C35
Channing—Guide to the Study of American	973 C36
Coffin—Building the Nation	J973 C65
Eggleston—First Book of American History	J973 Eg3
Eggleston—History of the U. S. and Its People	973 Eg3
Fiske—History of the U. S.	973 F54

Gordy—History of U. S. of America	973 G652
Gordy—Pathfinder in American History	973 G65
Hale—History of the U. S.	973 H13
Hamilton and Other Federalist	973 H18
Hart—American History Told by Contemporaries	973 H28
Hart—Formation of the Union 1750-1829	973-4 H25
Hathaway—1001 Questions and Answers of U. S. History	973 H28
Higginson—Young Folks History of the United States	J973 H53
Judson—Growth of the American Nation	973 J82
Lodge and Roosevelt—Hero Tales	973 L82
Jameson—Dictionary of U. S. History	R973 J23
MacLean—Mound Builders	973.1 M22
McMaster—With the Fathers	973 M221
Morris—Half Hours With American History	973 M83
Peabody—Chronological History of the U. S.	973 P31
Pratt—American History Stories	J973 P88
Schouler—Historical Briefs	973 Sch61
Swinton—History of U. S.	973 Sw6
Rosengarten—German Soldier in Wars of the U. S.	973 R69
Roosevelt—Winning of the West	975 R67
Walker—Making of a Nation	973.4 W17
Warner—Studies in the South and West	976 W24

DISCOVERY AND INDIANS.

Abbott—Northern Colonies	J970 Ab2
Abbott—Wars of the Colonies	J970 Ab21

Bell—Heroes of American Discoveries.....J970 B41
Brooks—Story of the American Indian.....970.1 B79
Drake—Indian History for Young Folks...J970.1 D78
Grinnell—Story of the Indian 970.1 G88
Higginson—Book of American Disocvery...J970 H53
Jackson—Century of Dishonor 970.5 J13
Parkman—Conspiracy of Pontiac and the Indian
War 970 P231
Parkman—Half Century of Conflict......970 P2317
Parkman—Montcalm and Wolfe..........970 P2313
Parkman—Pioneers of France in the New World..
....970 P2315
Saunders—Story of Discovery of New World by
Columbus 973.1 Sa8

COLONIAL.

Coffin—Old Times in the Colonies........J973.2 C65
Doyle—Virginia, Maryland and Carolinas..973.2 D77
Drake—Tea Leaves 973.2 D78
Eggleston—Beginning of a Nation........973.2 Eg3
Fisher—Colonial Era 973.2 F53
Hopkins—Youth of the Old Dominion....J973.2 H77
Lodge—Short History of the English Colonies in
America 973.2 L82
Tomlinson—Three Colonial Boys........J973.2 T59
Thwartes—Colonies, 1492-1750 ....973.2 T42
Ward—Old Colonial Days 973.2 W24

REVOLUTION.

Abbott—Blue Jackets of '76 ....J973.3 Ab2
Brooks—Century Book of American Revolution.
....J973.3 B79

Brown—Besides Old Hearthstones	973.3 B81
Brown—John Hancock, His Book	B H1922
Butterworth—Patriot Schoolmaster	J973.3 B97
Cable—Creoles of Louisiana	973.3 C11
Coffin—Boys of '76	J973.3 C65
Drake—Campaign of Trenton, 1776-7	973.3 D78
Drake—Watchfires of '76	J973.3 D79
Fiske—American Revolution	973.3 F541
Fiske—Critical Period of American History	973.3 F5411
Greene—Historical View of the American Revolution	973.3 G83
Lossing—Pictorial Book of the Revolution	973.3 L89
Sloane—French War and the Revolution	973.3 S15
Stratemeyer—Minute Boys of Lexington	J St811
Tomlinson—Stories of the American Revolution	J973.3 T5911
Tomlinson—Three Young Continentals	J973.3 T59
Tomlinson—Washington's Young Aids	J973.3 T591
Tyler—Literary History of American Revolution	973.3 T97
Watson—Old Bell of Independence	J973.3 W33

CONSTITUTIONAL AND POLITICAL.

Bryce—American Commonwealth	321 B84
Cleveland—Principles and Purposes of Our Form of Government	351 C59
Fiske—Civil Government in the U. S	320 F54
Frothingham—Rise of the Republic of the U. S.	320 F93
Griffin—Civics for Young Americans	J320 G36

Hitchcock—American State Constitutions	342 H52
Judson—Young America	J320 J92
Lawton—American Caucus System	324 L41
Milford—The Nation	320 M88
Nordhoff—Politics for Young Americans	J320 N75
Preble—History of the Flag of the U. S. of America	929.9 P91
Scott—Repudiation of State Debts	336.3 Sco3
Tausig—Tariff History of the U. S.	337 T19
Tocqueville—American Institutions and Their Influences	342 T561
Wells—National Hand-book of the Political History of America	973 W46
Wilson—National Democratic Party	329 W69

WAR OF 1812.

Abbott—Blue Jackets of 1812	J973.5 Ab2
Barnes—Naval Actions of the War of 1812	973.5 B26
Lossing—Pictorial Field Book of 1812	973.5 L89
Soley—Boys of 1812	J973.5 So4
Stories of the War of 1812	J973.5 St7
Roosevelt—Naval War of 1812	973.5 R67
Tomlinson—Boy Officers of 1812	J973.5 T591
Tomlinson—Boy Soldiers of 1812	J973.5 T59
Tomlinson—Boys With Old Hickory	J973.5 T5911
Tomlinson—Guarding the Border	J973.5 T5912
Tomlinson—Search for Andrew Field	J T59
Tomlinson—Tecumseh's Young Braves	J T5911

CIVIL WAR.

Abbot—Battlefields of '61	J973.7 Ab2

Abbot—Battlefields and Victory	J973.7 Ab211
Abbot—Blue Jackets of '61	J973.7 Ab21
Blaine—Twenty Years of Congress	973.7 B57
Brooks—Washington in Lincoln's Time	973.7 B79
Champlin—Young Folks' History of the War for the Union	J973.7 C35
Coffin—Boys of '61	J973.7 C65
Coffin—Drum-beat of the Nation	J973.7 C651
Coffin—Following the Flag	J973.7 C6511
Coffin—Marching to Victory	J973.7 C6512
Coffin—My Days and Nights on the Battlefield	J973.7 C6513
Coffin—Freedom Triumphant	J973.7 C6514
Davis—Short History of the Confederate States	973.7 D291
Dodge—Birds-eye View of Our Civil War	973.7 D66
Foster—New Jersey and Rebellion	973.7 F81
Greeley—American Conflict	973.7 G81
Hale—Stories of War	J973.7 H13
Harris—Trent Affair	973.7 H24
Kieffer—Recollections of a Drummer Boy	J973.7 K54
Knox—Lost Army	J973.7 K77
Logan—Great Conspiracy	973.7 L82
Longstreet—From Manassas to Appomattox	973.7 L86
Paris—History of the Civil War in America	973.7 P21
Phisterer—Statistical Record of the Armies of the U. S.	973.7 P55
Porter—Naval History of the Civil War	973.7 P831
Soley—Sailor Boys of '61	J973.7 So4
Stoddard—In White House in War Times	973.7 St6

Toombs—New Jersey in the Gettysburg Campaign	973.7 T61
War Lyrics	973.7 W19
Webb—McClellan's Peninsular Campaign	973.7 W38
Wilson—Division and Reunion	973.7 W69

MEXICO.

Hale—History of Mexico	972 H13
Prescott—Conquest of Mexico	972 P92
Wallace—Fair God, a Tale of the Conquest of Mexico	W 1521

LATEST PERIOD.

CUBA. HAWAII. SPANISH-AMERICAN WAR.

PHILIPPINES—PORTO RICO.

Andrews—Last Quarter Century in the U. S.	973.8 An2
Butterworth—South America	980 B98
Butterworth—Story of America	973 B98
Cabrera—Cuba and the Cubans	972.91 C11
Davis—Cuba and Porto Rican Campaigns	973.8 D29
Cuba in War Times	917.29 D29
Fiske—Story of the Philippines	991.4 F54
Flint—Marching With Gomez	972.91 F64
Halstead—Our Country in War With Other Nations	973.8 H16
Halstead—Story of Cuba	972.91 H16
Hill—Cuba and Porto Rico, with the Other Islands of the West Indies	972.9 H55
King—Hand-book of the United States	973 K58
Musick—Hawaii, Our New Possessions	996.9 M97

Murray—Cuba 972.91 M96
O'Hagan & Kaufman—Cuba at a Glance..972.91 Oh1
Ober—Puerto Rico and Its Resources......972.9 Ob2
Palmer—Again in Hawaii 996.9 P18
Roosevelt—Winning of the West 975 R67
Sherman—Reocllections of Forty Years....973.8 Sh5
Spears—Our Navy in the Spanish War.......359 Sp3
Stevens—Yesterdays in the Philippines....919.14 St4
Tupper—Columbia's War for Cuba........973.8 T83
Vivian—Fall of Santiago................973.8 V83
Watterson—History of the Spanish-American War
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THIS CIRCULAR CONTAINS:

FIRST:—A description of the courses of instruction in The International Correspondence Schools; a list of the instructors, and a table showing the number of foreign students enrolled and the countries in which they reside. It also contains a brief history of the schools, and a full description of the method of teaching employed. It shows how admirably the method meets the requirements of those who, for want of time and means, cannot attend regular schools, and calls attention to its original features, which make it more thorough and practical than correspondence instruction as conducted in other institutions, its superiority over night schools and the reading of text-books; and the magnificent opportunities our schools offer professional and workingmen, superintendents and foremen, mechanics and young men commencing life, to make up deficiencies in education or to increase their acquirements in technical knowledge. It gives the requirements for admission, rules for enrolling, prices of scholarships and other expenses, and information regarding the diplomas and certificates of proficiency granted.

SECOND:—Details of the courses of study in electrical engineering and electrical power and lighting; the prices of scholarships; terms of payment; diplomas granted, etc., etc., together with a statement of what electrical engineers, armature winders, draughtsmen, machinists, steam engineers, linemen, motormen, dynamo tenders, etc., etc., require to know of the theory of their respective trades, and why they should take advantage of the chance offered to study in The Correspondence School of Electricity.

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THE CORRESPONDENCE SCHOOL OF MECHANICS.

Scholarships.	SUBJECTS TAUGHT.	
Complete Mechanical Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Heat,	Mechanical Drawing, Steam and Steam Engines, Strength of Materials, Applied Mechanics, Boilers, Machine Design, Dynamos and Motors.
Mechanical Drawing Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas,	Mechanical Drawing.

☞ We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.

THE CORRESPONDENCE SCHOOL OF STEAM ENGINEERING.

Scholarships.	SUBJECTS TAUGHT.	
Stationary Engineers' Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics, Mechanical Drawing (Stationary Division),	Steam and Steam Engines (Stationary Division), Steam Boilers (Stationary Division), Dynamos and Motors.
Marine Engineers' Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics, Mechanical Drawing (Marine Division),	Steam and Steam Boilers (Marine Division), Steam Engines (Marine Division), Dynamos and Motors.
Locomotive Engineers' Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics,	Mechanical Drawing (Locomotive Division), Locomotives, Dynamos and Motors.

☞ We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.

THE CORRESPONDENCE SCHOOL OF ARCHITECTURE.

Scholarships.	SUBJECTS TAUGHT.	
Complete Architectural Scholarship.	Arithmetic and Algebraic Formulas, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Geometrical Drawing, Architectural Drawing, Part 1, Ornamental Drawing, Architectural Drawing, Part 2, Strength of Materials, Masonry, Carpentry and Joinery,	Structural and Ornamental Iron Work, Roofing, Plumbing and Gas-Fitting, Sheet Metal Work, Heating and Ventilation, Electric Light Wiring and Bell Work, Painting and Decorating, History of Architecture, Architectural Design, Specifications, Contracts and Permits, Estimating.
Architectural Drawing and Designing Scholarship.	Geometrical Drawing, Architectural Drawing, Part 1, Ornamental Drawing, This Scholarship includes a large number of Drawing Plates.	Architectural Drawing, Part 2, History of Architecture, Architectural Design.
Architectural Drawing Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas,	Geometrical Drawing, Architectural Drawing, Part 1.

☞ **We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.**

THE CORRESPONDENCE SCHOOL OF PLUMBING, HEATING AND VENTILATION.

Scholarships.	SUBJECTS TAUGHT.	
Sanitary Plumbing, Heating and Ventilation Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics, Drawing, Plumbing and Drainage. Gas-Fitting,	Electric Light Wiring and Bell Work, Fundamental Principles of Heating and Ventilation, Heating by Steam, Heating by Hot Water, Heating by Hot Air.
Sanitary Plumbing and Gas-Fitting Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics,	Drawing, Plumbing and Drainage, Gas-Fitting, Electric Light Wiring and Bell Work.
Heating and Ventilation Scholarship.	Arithmetic, Mensuration and the Use of Letters in Algebraic Formulas, Mechanics, Drawing,	Fundamental Principles of Heating and Ventilation, Heating by Steam, Heating by Hot Water, Heating by Hot Air.

☞ **We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.**

THE CORRESPONDENCE SCHOOL OF CIVIL ENGINEERING.

Scholarships.	SUBJECTS TAUGHT.
Civil Engineering Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Heat, Mechanical Drawing, Elementary Graphical Statics, Strength of Materials, Analysis of Stresses, Proportioning the Material, Details of Construction, Bills and Estimates, Steam Engines, Steam Boilers, Locomotives, Applied Mechanics, Machine Design, Descriptive Astronomy, Surveying, Land Surveying, Mine Surveying, Mapping, Railroad Location, Railroad Construction, Track Work, Railroad Structures, Elementary Chemistry, Economic Geology, Mineralogy, Blowpiping, Drainage, Sewerage, Highways, Paving, Water Wheels, Hydraulic Machinery, Water Works, Plumbing and Drainage, Gas-Fitting, Principles of Heating and Ventilation, Heating by Steam, Heating by Hot Water, Heating by Hot Air, Fundamental Principles of Electricity, Electrical Measurements, Batteries, Applied Electricity, Dynamo-Electric Machine Design, Power Transmission.
Railroad Engineering Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Mechanical Drawing, Strength of Materials, Surveying, Land Surveying, Mapping, Railroad Location, Railroad Construction, Track Work, Railroad Structures.
Surveying and Mapping Scholarship.	Arithmetic, Algebraic Formulas, Geometry and Trigonometry, Geometrical Drawing, Surveying, Land Surveying, Mapping.
Bridge Engineering Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Mechanical Drawing, Elementary Graphical Statics, Strength of Materials, Analysis of Stresses, Proportioning the Material, Details of Construction, Details, Bills and Estimates.
Municipal Engineering Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Mechanical Drawing, Strength of Materials, Surveying, Land Surveying, Mapping, Plumbing and Drainage, Gas-Fitting, Principles of Heating and Ventilation, Heating by Steam, Heating by Hot Water, Heating by Hot Air, Drainage, Sewerage, Highways, Paving.

Hydraulic Engineering Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Mechanical Drawing, Steam and Steam Engines, Steam Boilers, Strength of Materials, Machine Design, Water Wheels, Hydraulic Machinery, Water Works, Surveying.
Mathematics and Physics Scholarship.	Arithmetic, Algebra, Geometry and Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Heat.

☞ **We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.**

THE CORRESPONDENCE SCHOOL OF BOOKKEEPING AND STENOGRAPHY.

Scholarships.	SUBJECTS TAUGHT.
Bookkeeping and Business Forms Scholarship.	Arithmetic, Penmanship, Single Entry Bookkeeping, Double Entry Bookkeeping, How to Change from Single Entry Bookkeeping to Double Entry Bookkeeping and *vice versa.* The subjects of this Course are taught separately when desired.
Complete Stenographic Scholarship.	Spelling, Penmanship, Grammar, Letter Writing, Stenography. The subjects of this Course are taught separately when desired.
Complete Commercial Scholarship.	Arithmetic, Spelling, Penmanship, Grammar, Letter Writing, Single Entry Bookkeeping, Double Entry Bookkeeping, How to change from Single Entry Bookkeeping to Double Entry Bookkeeping and *vice versa*, Stenography. The subjects of this Course are taught separately when desired.

☞ **We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.**

THE CORRESPONDENCE SCHOOL OF ENGLISH BRANCHES.

Scholarships.	SUBJECTS TAUGHT.
English Branches Scholarship.	Arithmetic, Spelling, Penmanship or Letter Writing, Grammar, Geography, U. S. History, U. S. Civil Government. The subjects of this Course are taught separately when desired.

☞ **We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.**

THE CORRESPONDENCE SCHOOL OF SHEET METAL PATTERN CUTTING.

Scholarships.	SUBJECTS TAUGHT.
Sheet Metal Pattern Cutting Scholarship.	Arithmetic, Algebraic Formulas, Geometry and Trigonometry, Geometrical Drawing, Sheet Metal Pattern Cutting.

☞ We issue Circulars of Information, in which the above Scholarships are described in detail; they are sent free on application. When sending for circulars please state the Course in which you are interested.

OFFICERS OF INSTRUCTION AND GOVERNMENT.

T. J. FOSTER,
Manager.

J. J. CLARK, M. E.,
Instructor in Mathematics and Mechanics.

BENJ. F. LA RUE, Civil Engineer,
Instructor in Bridge and Railroad Engineering.

THOS. THOMSON, Sanitary Engineer,
Instructor in Sanitary Plumbing, Heating and Ventilation.

W. SCOTT COLLINS, Architect,
Instructor in Architecture.

WM. H. DONNER, Electrical Engineer,
Instructor in Electricity.

RUFUS J. FOSTER, E. M.,
Instructor in Mining.

CHAS. J. HAYES,
Instructor in Ornamental Drawing.

L. H. KJELLSTEDT, C. E.,
Instructor in Mechanical Drawing.

JOHN A. GRENING, M. E.,
Instructor in Steam Engineering.

WILLIAM TATE, E. M.,
Instructor in Mining.

D. COMINGS,
Instructor in Ornamental Drawing.

LOUIS A. OSBORNE,
Instructor in Architecture.

W. FRANK SIMONDS,
Instructor in Architectural Drawing.

RUDOLPH PRESCH,
Instructor in Ornamental Drawing.

CLASSIFIED LIST OF STUDENTS OF THE SCHOOLS

Outside of the United States, Canada and Mexico.

APRIL 1st, 1897.

NORTH AMERICA.

Antigua	1	Hayti	1
Bermuda	1	Jamaica	5
Cuba	1	Newfoundland	6
Guatamala	4	Nicaragua	1

SOUTH AMERICA.

British Guiana	4	Colombia	1
Brazil	1	Ecuador	1
Chile	1	Isla de Naos	1

EUROPE.

Belgium	2	Scotland	13
England	31	Spain	5
France	1	Sweden	2
Germany	7	Switzerland	1
Italy	1	Wales	5

ASIA.

Burmah	1	Japan	15
China	2	Straits Settlements	1
India	7		

AFRICA.

Cape Colony	1	Natal	5
Mauritius (Mascarene Islands)	1	South African Republic	12
Namaqualand	1	Transvaal	2

AUSTRALASIA.

Hawaiian Islands	6	Queensland	2
New South Wales	9	Tasmania	2
New Zealand	4		

NOTE.—Any one desiring may verify these figures by calling at our offices, at Scranton, Pa.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS.

"To be accurate, write ;
To remember, write."

The International Correspondence Schools were first to give instruction by correspondence in the theories of the trades and engineering professions, and have done more within the last five years to benefit miners, mechanics and others in need of technical instruction than any other educational institution. The system of instruction they originated has developed into the largest technical school in the world, has overcome the difficulties which attend these classes in their efforts to educate themselves at night school or by home study with text-books, has placed technical education within the reach of thousands who would otherwise have remained in ignorance of the theories of their trades, and has helped hundreds to become superintendents, foremen, draughtsmen, engineers, etc., who, without it, would never have obtained such positions.

History of Correspondence Instruction.

The man who first transmitted written intelligence to his neighbor originated correspondence instruction, and it has always been largely used among civilized people. All who are familiar with the New Testament know how generally the method was employed two thousand years ago.

The man who reads the world's doings in the newspapers, or the mechanic who is kept informed of the progress in his trade by his favorite technical journal is instructed in a measure by correspondence ; and to a greater or less degree it is made to contribute to all mental improvement.

Application by Us to the Theories of the Trades.

In the last twenty-five years the method has come into more general use, but until within a very few years all teaching by correspondence was conducted with regular text-books, which are not as well adapted to correspondence instruction as text-books especially prepared for the purpose. Most workingmen do not have the preliminary education to understand them. Neither have they time to waste in studying things they will never use. In The International Correspondence Schools these objections are overcome with courses of instruction which begin at the beginning, require only a knowledge of reading and writing on the part of the student to commence, and for which the Instruction and Question Papers and Drawing Plates used in teaching have been expressly written and illustrated. To write and illustrate these Papers has required an expenditure of over $100,000. Without our original methods such growth as these Schools have experienced would have been impossible.

RAPID GROWTH.

An Original Undertaking.

In the month of August, 1891, the work of the first course (what is now the Complete Coal Mining Course) was laid out, and *the decision was made to prepare for use instead of text-books a series of Instruction Papers which should embody in the fewest and plainest words everything necessary to a complete understanding of the subject.* From this decision dates the beginning of correspondence instruction as now conducted.

Its Great Success.

The course became popular at once, because it presented to all classes of miners and mine officials an opportunity to obtain a systematic, thorough, and concise course of home instruction in the theory of coal mining. It met with such a hearty reception that within one year over one thousand men enrolled, and the practicability and great value of the new method of teaching to the large classes who cannot leave home or quit work to attend a regular school to obtain a technical education was demonstrated, and its future success could be counted upon.

Complete Mechanical and Mechanical Drawing Courses.

Early in 1892 the demand from machinists and others who wished to qualify to become mechanical engineers and draughtsmen became so urgent that the preparation of the Complete Mechanical and Mechanical Drawing Courses, intended especially for these classes, was commenced. Within eighteen months from their establishment, over two thousand enrolled in them.

Steam Engineering, Electrical, Architectural, Civil Engineering and Other Courses.

Since that time courses in Steam Engineering, Electricity, Architecture, Architectural Drawing, Civil Engineering, Bridge Engineering, Railroad Engineering, Surveying and Mapping, Municipal Engineering, Hydraulic Engineering, Plumbing, Heating and Ventilation, English Branches, Bookkeeping, etc., have been added, and the Schools have continued to grow until instruction is now given in thirty Scholarships. The Schools are now teaching by mail persons residing in thirty-six States, and countries outside of the United States, Canada, and Mexico.

Practical Plan of Home Study:

The Schools are not intended to take the place of the regular technical schools and colleges, and those who are in position to attend such institutions are advised to do so. Their province is to provide education for the thousands who want to improve their condition in life, but who cannot afford to quit work or leave home to study. For the first time, a practical and efficient system of instruction is offered to these classes.

Our Success in Teaching.

Our scholars are unanimous in praising the method of instruction and the attention received from instructors, and without exception, when they apply themselves, make satisfactory progress.

Adapted to the Needs of All.

Correspondence instruction is adapted to all. We accept students of any nationality or color, sex or religion, from ten years old upward, and point with well-earned pride to the thousands who have reached the goal of technical education by this path. In times past three great factors—age, time, and expense—have chiefly controlled the educational acquirements of men, but these have been largely removed by the correspondence method of instruction. Here is a system which enables the workingman to overrule the circumstances which have hitherto hedged him about. None of these factors are now barriers to the advancement of ambitious men. Those of mature years take advantage of this method as well as the young and inexperienced. The value of every hour is enhanced by the ability to use it in preparing for advancement. The expense is reduced to a minimum.

Proofs. Persons who think of enrolling as students and who wish to have evidence of the utility and practicability of the method of instruction from those who have already tried the plan should write us, and we will send them a copy of our large book of testimonials, or the name and address of a student in any locality of the United States, Canada, or Mexico, to whom they can write for information.

METHOD OF TEACHING.

Short Lessons. The Instruction Papers which are the text-books for our students are printed pamphlets or books of 30 to 150 pages, similar to specimen pages shown in the latter part of this circular. All Instruction Papers, except those on Drawing, are accompanied by Question Papers containing questions upon the subject under study.

When a student enrolls he receives his first and second sets of Instruction and Question Papers. Accompanying these four pamphlets are printed instructions telling him what his class letter and number is, how to proceed with his work, and how to study. After reading these instructions the student studies his first Instruction Paper. The first subject is either Arithmetic or Drawing, but whichever it is, it is commenced at the very beginning, on the assumption that the student knows nothing of it, and the ground is covered in the clearest and most concise language. Usually the first subject is Arithmetic.

How the Student Studies. After having thoroughly mastered the first Instruction Paper the student lays it aside and takes up his Question Paper (which contains many practical problems), and answers in turn every question, upon sheets of foolscap, writing on one side of the paper only; he then puts his work in an addressed envelope which is provided by the School for the purpose, and mails it.

Correction of His Work. When a set of answers is received by the School it is examined with the utmost care; all errors are corrected in red ink, and the work is returned with such suggestions and criticisms as will enable the student to understand the subject. In this way every mistake is pointed out and everything fully explained.

Upon the criticisms which a student's papers receive will largely depend his career as a student. The Instructors take pains to make the student feel that the comments made are for his best interests. Experience has shown that written criticisms are the most valuable and make more lasting impressions than verbal ones.

Percentage Marks. A percentage mark is given according to merit. If the paper does not deserve 90 per cent, the student is required to rewrite the incorrect part of the work until he satisfies the Instructor that he understands it. If necessary, additional work is given him, but in any event the student is kept at that subject until he has learned it. There is no way of slighting the work.

When students do not receive 90 per cent on their papers, which is not often, the trouble is traceable in nearly every instance to their failure to study the Instruction Papers carefully. The Instruction Papers are *so plain* that any one who will study them as directed can understand them, and are *so complete* that any one who understands them can readily answer all the questions in the Question Papers.

How the Student is Kept at Work.

When the student mails his work on Question Paper No. 1, he commences the study of Instruction Paper No. 2, and proceeds with it as with the previous Paper.

When he has gained a passing mark in Question Paper No. 1, his work is returned to him to keep, and at the same time Instruction Paper No. 3 and Question Paper No. 3 are sent him.

When he receives No. 3 Papers, he lays them aside until he has finished No. 2. When he mails his work on No. 2, he takes up No. 3, and when his work on No. 2 is returned to him, he is sent No. 4 Papers, and so on. By this system the student has always a set of Papers on hand to study while the work on the other set is going through the mail.

He Receives Personal Assistance.

When a student meets with difficulty in understanding anything in the Papers, the Instructors of the School come to his assistance through the mails.

For this purpose each student is furnished by the School, free of charge, with addressed envelopes and information blanks. A copy of the latter is printed on the next page.

When the student has given a subject a thorough trial and cannot understand it, all he has to do is to fill out one of these blanks, stating the difficulty, and mail it to us.

Full Explanations.

When this is received, the Instructor answers it by return mail. *He explains fully, if it requires a dozen sheets of paper to do so.*

We would rather have a student write to us for explanations every day, than fail to understand a principle or anything treated of in the Instruction Paper. " Difficulties exist but to be removed," and it is our business to remove them.

All Text-Books are Free.

The Instruction and Question Papers are the only text-books the student requires. They become his property, and are not returned to us.

We pay all postage in sending papers or communications to the students. They pay the postage on their mail to us.

When a man has completed a Course he must pass a final examination before he is given a Diploma or Certificate of Proficiency.

School Records.

The records kept are very full. They form a complete school history of the student from his enrollment until he receives his Diploma. They contain not only the percentages given upon each Plate and Question Paper, but such details of his work as to enable us to form an accurate opinion of his ability and status as a student.

Information Blank.

The International Correspondence Schools.

SCRANTON, PA., U. S. A.

Observe the following Points when Using this

INFORMATION BLANK:

When to be Used.

(1) Use it whenever, after a fair trial, you cannot understand the principles stated in the Instruction Papers or cannot work the problems in the Question Papers.

(2) Be sure to give ALL the data asked for on this blank.

How to be Used.

(3) When asking for information regarding an example, the printed answer of which you are unable to obtain, ALWAYS SEND US YOUR SOLUTION, or your work as far as you can go, thus we can see just where your error lies, if any exists, and we can give you exactly the information you need. Sometimes your answers may differ from ours owing to the number of decimal places carried (usually, four are sufficient, but some calculations require more). We make no deduction from your mark in such cases provided your work and principle are correct.

(4) ALWAYS WRITE YOUR ADDRESS IN FULL ON EVERYTHING YOU SEND US.

USE THE YELLOW BLANK LAST.

Name of Student. .... Class Letter and

No. .... Post-Office .... State ....

No. of Question .... Page ....

In the .... edition of Paper, subject ....

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Date .... 189...

HOW DRAWING IS TAUGHT.

Method of Teaching Drawing Unsurpassed.

Our method of teaching drawing is original and practical, and is unsurpassed in any school in the world. It is unequalled except in a very few regular universities and technical colleges of the highest grade. None have ever failed to learn to draw by our method when they have followed our instructions. Many have been qualified to fill positions as draughtsmen who, before they enrolled with us, had never used a drawing pen or pencil, and whose hands and fingers were as rough and stiff, because of hard work, as they could well be.

Every Drawing Original with Us.

It seems an incomprehensible thing to many how drawing can be taught through the mails, yet we have qualified thousands to make neat, well-lettered drawings without ever seeing or conversing with one of them. This is due to the clear, simple, and concise way in which our Instruction Papers on drawing are prepared, to the great care taken in correcting the work of our students, and to the superior character of the model drawings which we send to our students to work from. Every one of these drawings is made with pen and ink in our own establishment, and the copies sent to students are printed from zinc etchings made from our original drawings by the photographic process. The preparation of these drawings has taken much time and money.

Instruction Carefully Graded.

In our drawing courses the student is not required to draw first a hard plate, then an easy one, then a hard one, and then another easy one, etc. His first plate consists of a few simple straight and curved lines, his second is a little more difficult, his third still more so, and so on. The last plates in the course are as difficult as any ordinary draughtsman is ever called upon to draw, and by the time our students reach the last plates in their courses the work which they do upon them will compare very favorably with that done by any draughtsman. We have never met with any one whom we could not teach to draw, many of our students completing the work within four months.

First Instruction Paper and Drawing Plates.

When the student is ready to take up this subject the first Instruction Paper in drawing, together with an empty mailing tube, is sent to him. This Instruction Paper contains detailed instructions on the use and care of the drawing instruments, on penciling, inking, etc., and also for drawing the first few plates.

The student studies the Instruction Paper and draws Plate I, which when completed he sends to us, in the mailing tube above mentioned, for examination and correction.

Important Work of the Instructor.

When the plate is received at the School the Instructor in drawing examines it carefully and notes upon it in pencil the points in which it can be improved and his suggestions for the guidance of the student. If necessary, he writes a letter covering everything thoroughly, so that the student may have full benefit of his knowledge and experience.

The plate is then returned, with these criticisms and suggestions, to the student. If he has not received a mark of 90 per cent he is obliged to redraw it until he does, which will not be until we are satisfied with the neatness and accuracy of the drawing, and believe that he thoroughly understands the principles involved.

When the student receives a passing mark on Plate I, he sends us Plate II, on which he has been working while Plate I has been in our hands, and begins work on Plate III.

Order of Work.

The student is required to make from fifteen to forty plates and two or more tracings, depending upon the course in which he enrolls. The plates and tracings, excepting the first few, which are drawn from directions in the first Instruction Paper, are furnished to the student one at a time in the same order as the Instruction and Question Papers in other subjects. Thus, when Plate VIII is returned to the student, it is accompanied by a copy of Plate X, and so on. In this way the student is never out of work, but we do not send plates in advance of the order in which we have arranged them for teaching.

Second Instruction Paper.
Tracings and Blue Prints.

In due order and with the proper plate the second Instruction Paper in drawing is sent to the student. This explains the advanced principles, gives directions for the work on the remaining plates, and contains full instructions for tracing, preparing blue print paper, and taking blue prints.

We reserve the privilege, provided we desire to exercise it, of retaining several of the plates made by each of the students, to show the progress they make.

Exceptionally Good Results Obtained.

The average student, after completing any one of our courses, can make a neat and well-lettered drawing, and with practice may become an expert draughtsman. We can teach any man to make a good drawing. Laborers and clerks learn to make them under our instruction.

ADVANTAGES OF CORRESPONDENCE INSTRUCTION.

Deficiencies in Education can be made up.

Our method fills a great want, and fully fills it. It is an opportunity for the indigent student to get an education ; for the superintendent of an engineering establishment, who, by his natural gifts has attained a position of prominence, to make up the defects in education which hamper him in his efforts to climb higher ; for the ambitious workingman to secure independence ; for the poor man to redeem himself from poverty. He can study and work at the same time ; improve his mind and use his hands to earn the money to support himself and family ; make use of the odd bits of time, which, wasted, are not even missed, but which will enable him in a few years to become a leader in any department of knowledge.

Individual Instruction at Time and Place Best Suited to Student.

By the correspondence method each student is a class in himself.

He can select his own time for study and can carry his studies with him, so that whenever and wherever he has any spare time he can make good use of it.

Wherever the mails go the student can be taught, so that locations may be changed as often as desired.

He can study at home without interfering with his work or social engagements. He loses no time in going to and from school, and he need not get ready to go out.

When he has studied as long as he wishes he can retire, as he is at home and need not make a long trip on foot or in some conveyance.

The education goes to the student instead of the student going to the education.

Qualifies for Written Examinations.

Correspondence instruction strengthens those faculties which are particularly called into play at examinations—the power to correctly and promptly write out on paper answers to the questions asked. The student learns to express himself freely and grammatically on paper, and remembers what he learns, not because he writes his answers, but because he learns them so well that he can write them. Many a candidate has failed at an examination, because he was not able to write out answers to the questions fully and clearly, although he knew what the answers should be. The student is trained by this method of study so that when he goes before an examining board he is not in the position " of knowing what the answer is, but of not being able to put it in black and white."

When we write we unconsciously seek to express our ideas in as concise a manner as possible, for the reason that writing is more difficult than speaking. The faculty of being able to express things concisely is of the greatest importance to every person.

Instruction Confidential.

The correspondence student is taught confidentially and does not need to expose his ignorance to his associates.

Requires Thoroughness.

He must do his work thoroughly. In his recitations the gift of a naturally smooth tongue will not aid him in any attempt to conceal his ignorance of a subject. What may seem when spoken to be a very intelligent, clear explanation of a subject, when written will often appear indefinite, vague, and unsatisfactory. Written lessons are subject to more searching scrutiny than oral lessons. The correspondence student soon learns, what every student learns in time, that only by persistent toiling can his efforts be crowned with success. This creates self-dependence.

Every part of a correspondence lesson can be gone over repeatedly until it is fully understood.

Even the apparent misfortune of partial or entire lack of occupation may be turned to advantage by this method of home study.

Forms Habits of Accuracy.

Wise direction through correspondence by competent Instructors will produce better results than can be expected from unaided individual efforts. This method also tends to form habits of accuracy and thoroughness, since nothing can be skipped and the whole lesson must be learned and written.

While the student has the most skilful direction in his studies he is at the same time his own schoolmaster, and pursues his work without fear, constraint, or obligation. He studies because he desires knowledge which will aid him in his efforts for advancement, and not because he is obliged to.

Close Relations of Instructor and Student.

The relations of Instructors and students are more personal than is possible by any other system. In some colleges teachers have classes so large that they do not even know the majority of their pupils by sight. In such classes it is impossible for a student to receive personal instruction. The teacher cannot even give his whole attention to the one pupil who is reciting. He is obliged to keep the large class in order, and so necessarily is less careful than if occupied with but one at a time. On the other hand, the correspondence Instructor in reviewing and correcting the work of one student at a time is interested in him alone, and therefore can better see his defects. He does not know his pupil, and cannot be influenced by him in any way.

OUR IMPROVED METHOD.

No Fixed Time for Completion of Our Courses.

Recognizing that men who have but little time to devote to study should not be bound to a fixed time for the completion of their courses, The International Correspondence Schools do not have a fixed time for the beginning or completion of any course or any part of it. Students can enroll at any time; their instruction is commenced immediately, and we enter into a definite agreement with each one that as soon as his Scholarship is paid in full it shall be non-forfeitable, and continue in force until instruction is furnished in all the subjects included in it; that the student can lay aside his studies as often as he may find it necessary, and resume them again when he finds it convenient; that when Scholarships are purchased on the installment plan they are not forfeitable for failure to pay the installments promptly, and that if at any time the student desires to stop studying, he has the right to sell or give his Scholarship to some other person.

Scholarships Nonforfeitable and Transferable.

Special information is furnished students as often as desired, on blanks supplied by the School.

We Write and Illustrate Our Texts.

We write and illustrate, expressly for the purpose, all the text-books we use in teaching. This is necessary in order to insure the highest degree of accuracy, completeness, conciseness, and simplicity. We employ a large staff of engineers and draughtsmen exclusively in this work.

Our Texts are Accurate.

Our text-books are original in composition and illustration, and are not compilations from other technical works. Only the most competent engineers are engaged to write them. Each paper is edited by several other engineers, well versed in the subject of the paper. Two expert operators check on calculating machines every calculation. A large and costly library of standard scientific and technical works is at hand for reference. Our text-books contain fewer errors than any other text-books on the subjects of which they treat.

We Take Nothing for Granted

All of our Papers are written from the standpoint that the student has no other source of information. Our Instructors in writing the Papers endeavor to place themselves in the position of persons ignorant of the subject and then try to explain the various points. They try to provide for all the difficulties that will be likely to beset the students, and as a result, many things of great importance in practical work, which receive little or no attention in ordinary text-books, are treated fully. Nothing of value is omitted from any course.

Unnecessary Matter Left Out.

In explaining a subject our Instructors make every point clear, regardless of the space required to accomplish it, but at the same time every paper is made as concise as the nature of the subject will permit. Our students are not carried so deeply into some subjects as in the regular technical schools, because we leave out everything not necessary for them to learn in order to master the subjects we are teaching them. The study of scientific subjects is always interesting, and helps to train the mind, but our students are busy men who cannot afford to waste a minute in learning things which they do not require to know in order to be thoroughly informed in the theory of their occupations. Our Instruction Papers are so written as to teach the student everything that he needs to know, but they do not occupy his time with anything which is unnecessary.

Simplicity Secured at Any Cost.

Our Instruction Papers are written in clear, simple language, as free as possible from technical terms. Illustrations, wherever they will make the text plainer, are used freely. Great pains is taken to make the construction of sentences, the paragraphing, punctuation, etc., such as will not only make the meaning of the author clear, but will make the paper easier to study. Words whose meanings are not generally understood are avoided wherever possible for those more commonly used. The plan of simplicity was not adopted because we expected to teach only men of limited education, but because things which are stated in simple language are more readily comprehended by all.

Careful Preparation and Revision.

One of the greatest troubles with ordinary text-books is that they are written for men of scientific attainments. The aim kept in view in the preparation of our Instruction Papers has been to make them thorough, modern, and plain. We are constantly revising our texts, some of which are in the fifth edition.

When the student enrolls he is first taken in hand by a competent Instructor in mathematics. This teacher does not ask what the student knows or does not know. He assumes that he knows nothing and begins with him at the beginning of arithmetic. Sometimes a student says, "I don't want to bother with these things," but he is ready to confess afterward that the preliminary drill in arithmetic has made him more efficient.

System Thorough.

After the student is through with arithmetic he is taken into the other subjects, and goes through in regular order the mathematical and physical studies before he is allowed to undertake the advanced subjects. He masters each Instruction Paper in order, and his work is examined and passed upon by the Instructors, subject by subject, as he completes it. The student must be thorough, as he cannot advance unless he is proficient in preceding lessons. He must know arithmetic before he can study mensuration or algebra, and when he gets as far as the last subject in any of our technical courses, he must have completed all the subjects entering into a complete education in the branch of engineering he is studying ; otherwise, he could not have advanced. He therefore learns thoroughly as far as he proceeds. Our system thus overcomes the greatest objection to self-education by text-books, night schools, etc.—*i.e.*, that many of those compelled to resort to such aids to self-education read or study on so desultory a plan that they learn few things thoroughly.

Particular Attention to Backward Students.

We make our students do their work as it ought to be done, allow no medium papers to pass, and correct every error. When the answer papers of our students are examined we even correct and criticise the punctuation, capitalization, spelling, and penmanship The poorly written, poorly expressed paper receives more careful examination and consideration than the good one. Students are surprised in many instances to see with what care their work is examined, and how clearly and with what apparent ease they are helped over portions which puzzled them. A successful teacher once said, "The true art of teaching consists in knowing how to suggest."

An Inexpensive Method.

Our method is much less expensive than any other, for the reason that our students do not need to purchase any text-books whatever.

COMPARED WITH REGULAR SCHOOLS.

To take a course in a regular technical college is the best way to secure a technical education, but it is not possible for busy men to attend colleges

Our Schools are not intended to fill the place of these, but there are, nevertheless, some respects in which our method of teaching is superior to all other systems.

Correspondence Lessons Require Close Attention.

In any class lecture the attention may be drawn away by the surroundings. Oral explanations cannot always be grasped and retained in the memory as they are given, and while the student is thinking over a portion of the lesson, the teacher may get ahead of him ; and if he loses part of the lesson, he cannot understand the remainder. The directions and instructions given are general, and the student oftentimes fails to get assistance on the point, which, in his case, is most necessary. On the other hand, every part of a correspondence lesson can be read time and again.

The Teacher Instructs One Pupil at a Time.

The correspondence teacher comes in closer contact with the student than do teachers instructing large classes. When the Instructor is correcting the work or giving aid to the correspondence student, his mind is occupied with him alone, and he is thinking only of the defects of the student who at the time occupies his attention, and of what will benefit him. This results in better work on the part of the Instructor for the student than is possible when his attention is divided. Nevertheless, he does not know him personally, and hence, in correcting his work, nothing is missed and partiality is impossible.

Writing a Lesson Helps One to Remember It.

To remember a thing it is necessary to learn it well. To learn it well the attention must be fixed, so that a complete and clear impression may be made on the mind, that the matter may be thoroughly understood. It will be admitted that a thing which is both heard and read better commands the attention, is better impressed on the mind and is better understood than if heard only or if read only, and it is equally true that things which are read until they are understood and are afterward written down, are better remembered than those which are read only. We remember things we read and then write down better than we do those talked about, not because they are read and then written down, but because they are learned better. Practice obtained by correspondence students in writing all their work is a great benefit in preparing them to successfully pass written examinations.

Dull Students Succeed as well as Bright Ones. Each student is a class by himself, and his progress depends upon the time he can devote to study. One man may get through in a year, whereas it may take another longer, *but he reaches the goal all the same.* This is more than can be said of the regular schools, since in all of them students must keep up with the classes or drop the studies.

Nothing Interrupts the Work There are no vacation seasons. Nothing interferes to interrupt the work of the student. Persons can commence their studies any day of the year, and be as sure of thorough instruction if they begin at one time as at another. Studies can be interrupted whenever necessary, and resumed when convenient.

Books, Transportation, Board, etc., Saved. Our charges are much smaller than for similar courses in the regular schools. In addition, the student saves transportation to and from the school, board, and other expenses while there, books, etc. In studying with us he need not lose a moment from his work, or spend an hour away from home from the time he enrolls until he has earned his Diploma or Certificate of Proficiency.

Any person who wants to learn can do so by the correspondence method. Instruction can be imparted with as great facility by it as by any other means, and many learn by it who cannot be instructed in the usual way.

Competent Instructors. In The International Correspondence Schools students are taught by the ablest Instructors it is possible to procure, men of education and of large experience in the branches which they teach. These are assisted in the preparation of the Instruction and Question Papers by the ablest specialists in the country, who are employed expressly for the purpose. The students, therefore, have the advantage of the knowledge and experience of the ablest engineers and experts connected with the sciences they are studying.

Strong Endorsement. "Industry," of San Francisco, a leading technical journal, referring to our Schools, said : "It is the most original agency for technical education that has ever been devised, capable of an extension that has no visible limit, and portends a time when we will not set off a few of the most fortunate for education, but educate all up to the limits required in the application of the skilled arts. One effect will be to raise the standard of the ordinary courses in technical colleges and schools."

Texts Constantly Revised. "When a set school-book is done, and the plates made, there is an end, but in the present system a tentative course is possible. Change and improvement can go on continually ; not only this, the problems submitted can be nicely graded to the requirement and capacity of the student."

SUPERIORITY OVER NIGHT SCHOOLS.

Night Schools Unsatisfactory

Besides the many other disadvantages attending them, night schools teaching technical subjects must be located in populous districts, to justify the employment of competent Instructors, so that they are only found in the largest cities.

They fail to meet the great want of a system of teaching which can be taken advantage of by working, business, and professional men. When these classes use night schools in ignorance of a better system the results are not satisfactory.

Workmen Need Not Leave Home to Study by Our Method

In the case of the average mechanic, to attend a night school it is necessary, after he has returned from work, to spend from thirty minutes to an hour in bathing, shaving, putting on a "boiled" shirt, collar, cuffs, and his shifting clothing. About half the time that he has to devote to study is lost in putting himself in presentable condition to attend the night class and in the ride or walk to and from the place where it is held. He must go from home in all kinds of weather, and is sometimes unable to attend.

Few Can Attend Evening Classes Regularly.

Many cannot attend evening classes regularly. Their engagements to do so are unavoidably interrupted by the sickness of themselves or their families, or by important family or social duties. Men who are sufficiently ambitious and energetic to study at home usually stand best with their employers, and if a breakdown occurs or an extraordinary emergency arises, it is such men who are called upon to do night work. Again, the appointed hours are not always those which best suit them. If they lose a single lesson, it places them at a great disadvantage, because they do not understand what follows. It thus occurs that out of every four students attending night schools one is absent at every session, and only one in twelve completes the subjects taken up.

Our Students are Not Pushed nor Retarded by Others.

In a night school the students must keep a uniform pace in their studies, and it is either a pace too slow to suit the bright student or too fast for the dull one to keep up.

The correspondence student loses no time in going to and from school, but can study at home, without interfering with his work or social engagements, and when he misses an evening can pick up his studies just where he left off.

Studies Carried on Privately.

His objections to revealing to others his present knowledge or his rate of progress are respected, and nobody but his Instructor knows where he begins or how fast he gets along.

MUCH BETTER THAN HOME STUDY WITH TEXT-BOOKS.

Cheaper.

A course in our Schools is much less expensive than home study with text-books. It will cost hundreds of dollars to purchase books to cover the theory of a trade and the sciences related to it. Our students require no text-books except the Instruction Papers, which are furnished free of charge.

Includes the Preliminary Education Required.

The want of preparation in studying with text-books is a great hindrance. A student desiring to study, say, Mechanics, selects a book on the Steam Engine and reads. He soon feels there is something which he must learn before he can understand what he is reading. Glancing through the book he sees $H\ P = \frac{P\ a\ F}{33000}$, asks some one what it means, and is disheartened by being told that it is "Algebra." This is something he does not understand, and he lays the book aside with the conviction that it is too deep for him. This is an example of what befalls him in every branch of his reading. In all text-books it is taken for granted that the reader has some preparatory education, and if he has not he cannot read understandingly.

Provides an Order of Study

Text-books are countless in number, and many contain matter which is of little use, and unless the student has the assistance of some experienced person to point out what it is advisable to read, and what may be left alone, he will do much unnecessary reading and lose valuable time.

These many and serious disadvantages are overcome in The International Correspondence Schools by low prices for tuition, made possible by conducting the business upon a large scale.

Courses Begin at the Bottom.

The student commences with addition, and in order learns the various parts of arithmetic ; then takes up the next subject and passes through it in the same way, and so on until he thoroughly learns all the subjects in his Course. He is not passed in a principle or subject until he understands it, so that he learns as far as he advances. If he is studying advanced subjects he has mastered the simpler ones preceding it.

Aided by Instructor.

He is never stalled, because before starting to read on a new subject, he has learned what is necessary to understand it. He wastes no time, because he is carefully guided in all his work, and he makes rapid progress because he has the aid of the best Instructors.

A GREAT OPPORTUNITY FOR WORKINGMEN.

Desire for Improvement.

Few are satisfied with what they have in life ; the large majority are reaching out for something better. This desire for improvement is the incentive to education and invention ; it influences the ablest scientist and the humblest workman ; transforms night into day, swamps into cities, and deserts into gardens. To it we owe the advancement of the human race.

Why Workingmen are Left Behind.

In the race of life the man who earns his bread by work with his hands is generally the one left behind. Such a man, endowed with the same brain power as others, wonders at times why he is not more fortunate. The problem is easily solved. Compelled to leave school at an early age, hard labor is his only resource.

He would have made a better place for himself had he received a better education with which to begin. Because of this want of education, he does the work he is told to do, but does not know why he does it.

Advantages of Education. An artisan may understand the use of a piece of timber and be unable to calculate the dimensions required for stability and safety. The latter qualification requires a knowledge of laws not learned in the ordinary routine of a man's daily toil.

Two men working side by side each do a certain stint, the one with much less exertion than the other. One knows the theory of mechanical forces and applies these forces to assist him. The man who has the most knowledge, and not the man who puts forth the most strength is the most profitable workingman.

Hypothesis. Most workingmen confuse the word *theory* with *hypothesis*. When a writer advances a statement that has not been proven, he states an *hypothesis*. When he says that something has been proven by the experience of men, he states a *theory*.

Theory. Theoretical education (or a knowledge of the experience of those who have preceded him in his trade or occupation) is necessary to the ambitious workman who, not content to remain at the foot of the ladder, desires to climb its rounds and secure promotion. Its great value is admitted in all industries, and those who are without it are placed at a disadvantage in the struggle for success. But few now hold the opinion that practice is the only education necessary to understand a business. **Practice.** Experience is absolutely necessary to make one expert in any trade or profession, but unless it is supplemented by technical (or theoretical) education, it will not qualify a person to gain the front rank in the close competition which characterizes the industrial activity of the day.

Demand for Educated Labor. The fact that the demand for skilled and intelligent labor is greater than the supply is proof that workingmen need education in the theory of their work, to enable them to better perform their duties and secure higher positions.

To Secure Promotion—Study "The best way to secure promotion is to increase in efficiency, to prove one's self larger than the position he occupies." It is the duty of all men to take advantage of every honorable opportunity to improve their financial and social positions and the conditions of themselves and families. Workingmen who make such efforts to advance are always the last to be laid off when work is slack, they are seldom discharged, and are the first to win promotion.

Workingmen Desire Education. Most workingmen feel their need of education, and by their hearty response to every effort to assist them, show how highly they appreciate it and how much they want to get it, but the means heretofore provided have not been adapted to meet their conditions.

The workingman who enrolls in The International Correspondence Schools is always under the charge of a competent teacher, who is ever ready to clear away difficulties and to sympathize with the efforts which he puts forth, no matter how inaccurate and imperfect they may at first be. Our Instructors know that most of those who are enrolled with us begin their studies at the close of a day's weary toil, while the many cares and anxieties of their daily lives are crowding close upon them, and they know, too, if the work which students send in for examination and criticism could but speak, what stories it might tell of hours of patient toil by the light of the midnight lamp. Knowing these things, they spare no effort to make the student's search for knowledge as easy as possible.

Their Requirements for Study Fully Met.

To study successfully, the workingman must be in a class by himself. He must be able to take up his studies whenever it suits his convenience, and lay them down whenever he finds it necessary. If he has a half hour of leisure during the day he must be able to take advantage of it. He cannot afford to lose, in dressing or in a long ride or walk, the hour succeeding his supper, when he is in the best condition to do good work.

But few men, until they have tried it, realize what a vast amount of work can be done in the hour from 7 to 8 P.M., which is so commonly wasted in getting ready to go out.

After he has devoted an hour or two to hard study, the workingman should be at home when he finishes, so that he can go to bed, without loss of time or exposure in a long night's walk or ride in inclement weather, and secure a good night's rest to prepare himself for work the next day.

Difficulties Overcome.

Text-books upon all subjects have served an important purpose in the cause of education. Night schools have aided many to convert their spare moments into knowledge and ultimately into success, but neither of these methods of study nearly fills the educational requirements of workingmen as well as correspondence instruction.

Every Home a School-house.

The International Correspondence Schools, by calling to their aid the fleet messengers of the postal service, meet the peculiar conditions which surround workingmen desirous of improvement, better than any other plan. Technical education is now within the reach of all. Every workingman may make of his home a school-house, where he can study during his leisure hours and prepare himself for a higher position in life.

All May Now Fit Themselves for Promotion.

This not only means that educational opportunities hitherto unattainable have been placed within the reach of many ambitious men, but also a widening in the field of human achievement, made possible through the more general education of workingmen. Every workingman can now qualify for the most responsible duties connected with his trade.

THE BEST METHOD FOR BUSY PEOPLE AND THOSE WHO CANNOT SPARE TIME FROM WORK.

Spare Moments May be Utilized.

Workers and busy people can obtain a knowledge of the theory of their trades in The International Correspondence Schools at a very moderate price. Some, however, hesitate to enroll because they think they have no time to study. To such we say, "There is no business which will not permit a man to give a little time every day to study."

Notable Instances of Education Obtained in Time Usually Wasted.

Longfellow wrote his translation of "The Inferno" by working in snatches of ten minutes a day while waiting for his coffee to boil. He persisted for years until the work was done. Humboldt had so little time for study that he read in the night or early morning while others were asleep. One of the most noted mathematicians in the United States acquired his education by devoting one hour a day to study. Millard Fillmore never saw a grammar or a geography until he was twenty years of age, yet he became President of the United States. Lincoln, while working at surveying studied law, and while clerking in a general store learned the English branches. Watt learned chemistry and mathematics while working at his trade as an instrument maker, and George Stephenson learned arithmetic while running an engine night shifts. He educated himself, and did much of his best work during his spare moments.

Opportunities for Study While at Work.

Some men have opportunities for study while at work. They should take advantage of such opportunities and plan to get them. Sitting for hours, gazing vacantly at machinery which is doing its work, does not constitute the best service. That man is rendering his employer the best service who, while doing his daily work as he ought, is fitting himself for service of a higher order. The workman who reads and studies most is the most competent, draws the highest pay, and is entitled to and receives the most respect.

Value of an Hour.

But no matter how employed or what may be the rules of employers regarding idle time while on duty, workingmen should remember it has been the men and women who have been most crowded with work who have done the greatest things in life, and that waste of time for those whose only hope of advancement lies in education means loss of opportunity and loss of hope. The man is yet unborn who rightly measures and fully realizes the value of an hour.

EMPLOYERS, SUPERINTENDENTS AND FOREMEN CAN MAKE UP DEFICIENCIES IN EDUCATION.

Those in Authority Should Know the "Whys and Wherefores."

Every employer and every one in a position of authority should know all the details of the business, and should learn the "reason why" of the duties performed by every employee, so that he can intelligently direct each and show that thorough knowledge of the subject which commands the respect of subordinates. If the plant is extensive, there are probably many trades represented, and the uneducated superintendent who is master of one, when dealing with those of which he is ignorant, must hire foremen who are expert in them, to whose superior knowledge he is compelled to defer—a harmful and humiliating necessity. In order that he may know as much or more than the foremen of all the departments under his charge, he must be educated.

They Can Educate Themselves in Our Schools.

A superintendent can learn in The International Correspondence Schools the reason for everything going on in the shops under his care. He can thoroughly educate himself in the theory of his business and do his work with little worry to himself and with satisfaction to his employer.

The foreman should make himself as efficient as possible, for if he does not know as much or more than the best-informed man among his subordinates, he occupies an unenviable position. The man who knows more than the boss is too valuable to discharge, and his superior knowledge is always unpleasantly putting itself in evidence. The foreman must lead in all things, but especially in theoretical knowledge. If he cannot read drawings understandingly, he is unable to detect errors or direct work to be made from them.

If They Will Study, Their Success is Assured.

The man who can successfully handle a gang of men so as to do satisfactory and economical work is bright and capable. He has the stuff in him for better things ; and it only requires well-guided and persistent study to bring it out. He can learn if he will study, and his studies need not interfere with his work.

The correspondence system is preferred by many because they are diffident about exposing their ignorance, as is necessary in a class-room. Many men who could not or would not study when young now occupy positions of responsibility, and are supposed by their employers and associates to have more theoretical knowledge than they possess.

Names of Students Not Published Without Permission.

The student of The International Correspondence Schools does not come in contact with other students, and his studies are privately and *confidentially* conducted We do not publish a list of our students, nor do we publish their names and addresses, unless they voluntarily give us testimonials.

A HELP TO PROFESSIONAL MEN.

All Important Data Epitomized.

It is a common expression with professional men, "Oh, I have got all the authorities on the subject in my book-case, and can look up the information at any time." Precisely so ; the information is in the book-case, and it remains there, too ! Then, when a question arises "all the authorities" are taken down and dusted, and an hour or two devoted to seeing what the authorities have to say, and other hours are wasted in vain endeavor to decide which authority to act on. It is here the great value of our work comes in. We dust the books and consult all the authorities, so to speak. We epitomize the most important data of the various engineering professions, and present it in clear and concise language to our students.

Successful Men Hard Students.

The most successful professional men are the hardest students. No man can afford to stop studying when he leaves college. When he commences the practice of his profession he finds that he needs to know thoroughly many things which he studied indifferently, and soon forgot, as well as many other things which he did not study at all. In order to be successful he must study.

There is no safe stopping-place ; the world continually moves forward, and a man must either keep up with the procession or fall behind. The intense fact of human life is change—movement ; a man must move, and unless he moves forward he will move backward. Study is the only sure protection against mental rust and retrogression.

It is the common experience of the young engineer to find himself out of employment. The new enterprise falls through; financial stringency compels a suspension of work; the corporation reorganizes, and the engineering force is succeeded by new appointments; the work is completed, etc.; these are a few of many causes which may throw him out of employment.

Idle Time May be Improved.

But whatever the cause of his enforced idleness, the question arises, what is to be done—what is the best thing to do? The thing which he usually does first is to look for another position. If he is not immediately successful, the next best thing to do is to improve his "idle" time. No time should be wasted. Every day and moment of life should in some way be made to return value. Many an engineer whose professional life has been a series of well-earned triumphs can look back upon unemployed periods, which he was wise enough to take advantage of for needed study, as having greatly contributed to his success. Many brilliant careers have had their beginnings when the engineer, having learned in practice his shortcomings and need of improvement, adopted the plan of devoting his idle days to study.

Engineers Can Study Other Branches.

Both engineers in general practice and those practicing specialties are the better equipped to make reputation and money, the more they know of all the different branches of civil engineering, as they are closely allied and frequently enter into the same undertaking. If an engineer, therefore, is thoroughly up in the branch he is practicing, he should occupy his leisure time in studying other branches.

For instance, it often happens that an engineer, following a general practice, finds that a knowledge of bridge designing would be very valuable to him. He is called upon to submit the design for a structure or to decide upon the merits of several designs. Such knowledge can be obtained in the Bridge Engineering Course of The International Correspondence Schools, which offer thorough and systematic courses of study in all branches of engineering.

Does Not Interfere with Professional Engagements.

The student pursues his studies without sacrificing any of his working hours. The lesson is studied at the time most convenient to him, and he can carry it with him, so as to make good use of every idle moment.

There are no vacations. Students receive instruction during the entire year.

If anything occurs to make the student interrupt his studies for any length of time, he is allowed the privilege of stopping, and at some future time when he finds it convenient to start at the point he left off, he can do so.

Texts Prepared by the Ablest Specialists.

He studies at home; is a class by himself, and is carefully guided by competent teachers. The text-books used are prepared expressly for the School by the ablest specialists, and contain only what is necessary. Students must do thorough work and are expected to ask questions, on blanks sent them, whenever they feel the need of help. Everything is taught from the beginning, and nothing is taken for granted. No extra charge is made, no matter how long it takes the student to finish.

APPRENTICES CAN OBTAIN EDUCATIONS.

Difficulty of Getting a Start in Life.

Young men commencing in life labor under great and serious disadvantages. The lack of education in special lines prevents them from making the most of their ability. Their services command little compensation, and their progress is slow.

Life Too Short to Learn Everything by Experience.

This is especially true of those who enter mechanical trades and engineering professions. Technical education is never satisfactorily acquired in the school of experience. The graduate of the technical school soon outstrips the man lacking this education, notwithstanding the latter may have the start of many years of practical experience. The demand of the present is for men who understand the theory of their trades, and without this knowledge, no man can hope for success.

How to Get the Desired Education.

How to obtain this education is the question which confronts young men. The great mass cannot afford to stop work or leave home to study. For this class, Correspondence Instruction solves the problem. It affords men an opportunity to acquire the same purely technical education as offered by our colleges and universities. It is adapted to the wants and needs of the classes for whom it is intended. While maintaining himself, and without leaving home, any young man can qualify himself for positions of trust and responsibility. All that is necessary is that he should make the most of his spare time. Mechanics, Steam Engineering, Electricity, Architecture, Plumbing, Heating and Ventilation, Civil and Mining Engineering, are successfully taught by mail.

Course for Apprentice Machinists.

The young man employed in a machine shop can take a course in mechanics, and acquire the theoretical knowledge of machine design, and through practical application of what he has learned eventually qualify himself as a mechanical engineer.

Courses for Apprentices to Electrical Trades.

He may be in the employ of an electric light, railway, power or supply manufacturing company. If so, a Mechanical-Electrical, or the Electrical Power and Lighting Course, will give him the theoretical knowledge which he must have to become a foreman, superintendent, or manager.

Courses for Apprentice Steam Engineers, Plumbers, Surveyors, Miners, etc.

Courses in Steam Engineering, Plumbing, Heating and Ventilation, Civil and Mining Engineering and other branches, are designed for the needs of those employed in these lines or who think of entering them. A thorough and practical knowledge of any one of these subjects will prove extremely valuable to its possessor. The Mechanical and Architectural Drawing Courses offer special possibilities. Many young men through taking the one or other have secured positions with mechanical engineers, large iron and steel and other manufacturing companies, in architects' offices, with contractors, builders, etc.

Promotions Usually Come to Educated Men.

The young man who possesses a thorough knowledge of the theory of any trade or profession has acquired the foundation for a successful career. It will enable him to perform his duties easier, and with greater satisfaction to himself and his employer. His services will become more valuable, and promotion and better pay will follow. Well-directed efforts count.

AN OPEN DOOR TO YOUNG MEN.

Many Young Men Unfitted for the Battle of Life.

The great majority of young men just leaving grammar and high schools are obliged to commence work at once for a living. Not possessing the means to continue their educations at technical and other schools, and so fit themselves for some particular calling, they turn their attention to the business opportunities that first offer. The engineering professions appeal to but few, for the majority think if they enter these fields, they can never become more than journeymen or subordinates. Accordingly, clerkships in stores and offices are accepted, and as clerks in stores and offices most of them continue to the end of their days. Thousands through this unfortunate error waste their lives, who, had they entered the mechanical trades and engineering professions, might have advanced to important positions.

Technical Education the Demand of the Times.

The young men of this country need to be awakened to the value of technical education. Great inventions and the successful completion of vast engineering projects form the greater part of the permanent history of the last one hundred years, and for years to come the greatest triumphs of men will be the mastery of the forces of nature and their subjection to the service of the race. A natural question is, who will fill the responsible positions resulting from this development? They must be men of practical experience and technical education. The answer is, they will be the men who now grasp every opportunity for knowledge, and educate themselves. Every young man who aspires to a home of his own, or to the respect and confidence of his employers, or the community in which he lives, *must*, in these times, obtain an education.

Profitable Positions for Those Competent to Fill Them.

In every engineering profession there is plenty of room at the top, and any young man, with fair natural ability, and a capacity for application to study and work, may hope to attain eminence in it. There is no path to human achievement that is barred from the labor and brain of young men.

How to Become a Mechanical, Electrical, Civil, Sanitary or Mining Engineer or an Architect.

A young man without means can learn the engineering profession of his choice by becoming an apprentice connected with it, or by entering the drawing-room of an engineering establishment. He can get his technical education from us by the correspondence method, and at the same time maintain himself. This is the best way to learn a profession, because the young man who learns a trade and also a profession is doubly equipped and is bound to succeed.

He can enter a machine shop as an apprentice, and by studying Mechanics and Mechanical Drawing at home qualify himself as a mechanical engineer.

He can secure employment with an electric light, railway or power, or supply manufacturing company, and through a correspondence course in Electricity fit himself for the position of foreman, superintendent, or manager.

He can engage as chainman on an engineering corps, and while performing subordinate duties, study to be a civil or mining engineer.

He can learn the carpentering or bricklaying trade, and by taking a course in Architecture and Architectural Drawing, become an architect, contractor, or builder.

Given the Benefit of Others' Experience.

Other courses present like opportunities. They are all designed to meet the needs of men who cannot leave home to study, and have only their spare time to devote to it. All that they must know is taught them, and each subject is so presented that they can grasp it. They are given the benefit of the experience of others, with competent Instructors to direct their efforts. A knowledge of the theory of any trade or profession is the foundation for a successful career. This foundation can be obtained through Correspondence Instruction.

A course in The International Correspondence Schools is, therefore, an "Open Door" through which the needy but industrious young man can enter the path to success and make for himself a useful and eminent career.

We Can Educate Your Sons

To those engineers, superintendents, foremen and others who have sons whose associations are such as to give them some familiarity with mechanical terms and machinery, and engineering subjects, The International Correspondence Schools are recommended as the best means of securing for them technical education. A course in these Schools will enable young men to efficiently fill responsible positions years before those who have not had such instruction.

Such men can recollect the difficulty they themselves experienced in mastering the "reason why" of their work, and they must see the great good which their boys will gain by being thoroughly educated in the theory of their avocations.

The instruction we give teaches young men the necessity of study as the opening wedge to advancement, and qualifies them to read understandingly technical books and papers.

To those who go through a course and pass the final examination, Diplomas or Certificates of Proficiency are given.

AN OPPORTUNITY FOR WOMEN.

Courses in Drawing and Designing.

Any woman gifted with artistic taste (what woman is not?) and who is desirous of becoming self-supporting, can qualify herself for pleasant and profitable work in an architectural or mechanical draughting-room by taking an Architectural Drawing and Designing or a Mechanical Drawing Scholarship.

In the best class of architects' offices there is a growing demand for women as designers of interior decorations, and numbers of women are already occupying such positions. Making tracings of either mechanical or architectural drawings is particularly agreeable work for women, and is not difficult to learn.

Teachers' Normal and Stenographic Courses.

Or a woman can take a course in The Correspondence School of English Branches and qualify herself for a teacher, or she can take a course in The Correspondence School of Stenography, and qualify herself for a position as a correspondent.

By the correspondence method each one is a class, his or her instruction being carried on privately and independently of any other student. This feature is appreciated by the considerable number of women now enrolled with us, many of whom do not care to have it known that they are pursuing a course of study by correspondence to fit them to earn a livelihood.

FOR THOSE OF LIMITED EDUCATION.

No man should hold back from enrolling because he is a poor writer or speller. Unless he tries to inform himself he will always remain ignorant, and there is no better way of learning to write and spell than in these Schools.

We advertise a thorough plan of education, and nothing can be thorough which does not begin at the beginning.

We Can Teach Any Man who will Study.

We can teach anybody, of any nationality or color, sex or religion, from ten years upward, who will study. The student must comply with one condition—viz., he must study. If he will study he can learn. We take a great deal of pains with backward students. They cannot exhaust our patience, and our best friends and strongest endorsers are those students with whom we have had the greatest trouble. Men have been taught arithmetic who could not do the simplest problem in addition when they joined the School.

The Dull Student Eventually Completes the Same Studies as the Bright One.

Some students can do their work more quickly than others, because of natural ability, previous education, or more time for study. Suppose two men join on the same day. One is brighter than the other, and is able to write out his answers to the questions in one of the Question Papers in, say, three days, while the other man takes, perhaps, a week. Now, if one student had to wait on another, the brighter student would be delayed in this case, but as every student is a class in himself, each is advanced in the course as fast as his ability will carry him, independently of others. But even if the dull student does progress more slowly, it is only a question of time until he completes the same studies.

We have the best instructors possible to procure, special pains are taken with dull students, and we never fail to educate any person who will study.

Testimonials.

The following are samples of hundreds of testimonials in our possession :

"I practically knew nothing of arithmetic when I started ; now anything ordinary is not difficult for me."

"I have gained more information in the short time I have been a student than I expected to in the whole course."

"When I first became a student I was ignorant of arithmetic, but I would not take five times the amount of the course for what I know about it now."

"When I enrolled, all that I could do was simple addition. I *could not do subtraction at all.* I am doing a lot better than I thought I should have done."

"For any one who, like myself, had no early education, it is one of the best investments to make. The cost is nothing compared to the benefits received in return."

"Your system of instruction is the simplest, plainest, and most complete that could be adopted for the education of men deprived of education in their younger days."

"I was sent to work when I was twelve years of age, and consequently suffered in my education, but thanks to The International Correspondence Schools, I am making up for what I have lost."

"My course with you is just like having some one by my side, the instructions are so easily understood. Branches that I thought I would never be able to understand, I have easily mastered."

"It seemed at first almost impossible for me to make any headway, but now, thanks to your kind words of encouragement and admirable method of teaching, I find that whatever lessons you send me are overcome by little patience."

"I cannot but be very well satisfied with my progress; thanks to your special trouble in regard to me. To those intending to follow any of the courses of your Institution I will most gladly testify to the value of your teaching."

"It is a thing I have been looking for for some time, having been put to work when I was quite young, and, like many others, deprived of early education. My only regret is that I did not hear of the School sooner than I did."

"I took a Scholarship in the English Branches about a year ago, and although I have only used my spare moments for study, the education I have already received through your correspondence method is certainly worth ten times the price I paid for my Scholarship."

Students Encouraged and Assisted.

The Correspondence Instructor, knowing that the learner's way is beset with difficulties, throws out many valuable hints adapted to the individual needs of the student, as brought out by his abilities and defects, as shown in his work. All efforts are appreciated, every improvement noted, and the learner encouraged in every way. The student has a conscientious and sympathetic friend to lead him on and need not fear to *trouble* the Instructors. It is their duty to render all possible assistance.

The student is taught not by text-books, but by Instruction Papers specially prepared by our own Instructors, and purposely written in the plainest, most concise manner possible. All unnecessary matter is omitted. The Instruction Papers are liberally illustrated by our own draughtsmen, and in every way special pains are taken with dull students.

Taught Until Qualified to Pass the Final Examination.

We enter into an agreement with each student to keep teaching him until he is qualified to pass the final examination and receive his Diploma or Certificate of Proficiency, no matter how long it may take, nor how often it may be necessary to review.

SUITED TO MEN OF MATURE YEARS.

No One too Old.

Mental Power Improves with Age.

A word to those who think they are too old to learn. It is a fact that a boy's brain does not attain its maximum size until he is about sixteen years of age, and that it does not mature until he is twenty-five. His physical powers do not mature until he is about thirty-five, and eminent authorities believe that a man does not attain his intellectual prime until he is forty-nine or fifty years of age, and that the best years of his life for study or work are after he has passed his fiftieth birthday. A famous Greek historian did not begin to study Greek until he was nearing the allotted span of threescore years and ten. Isaac Walton wrote some of his best works after he was eighty-five. Hobbes, at eighty-seven years of age, translated the "Iliad."

Conspicuous Examples.

Bishop John H. Vincent, Chancellor of the Chautauqua Schools, has long claimed that the best time for a man to study is from thirty to sixty, and the careers of Gladstone, Bismarck, David Dudley Field, Senators Edmunds and Sherman, and a host of others, prove that the period of highest usefulness may not be reached until a man has passed his seventieth, or his eightieth birthday. With the inspiration of such examples as these, how foolish it is for a man less than fifty years of age to think he is too old to study.

Average Ages of Our Students.

The average age of our students is almost twenty-seven. Nearly a third are over thirty, several hundred are over forty, and a number are over sixty years of age. It will thus be seen that age has nothing to do with it. It is merely a question of determination to make something of one's self.

The Ripened Intellect Grasps Quickly.

The best time to learn the A-B-C's and such simple things as require less the exercise of the reasoning faculties than child-like faith in what we are told, is when we are young, because then there is nothing else we can do. However, a man of forty years can learn to read as easily and as quickly as a child of five. At his time of life his intellect is riper and his mind in better condition to study larger things. *But it is in condition to study anything*, and it is only necessary that he form habits of application and logical thought to successfully study any scientific, technical, or other subject.

Importance of the Habit of Study.

We wish to place especial emphasis upon the formation of the habit of logical thought—the ability to investigate, to reason, to deduce conclusions—in short, the habit of study. This is the most valuable thing which a man gets in college; it is worth infinitely more to him than all the rules and formulas which he commits to memory. There is no sufficient reason why this habit of study may not be cultivated outside of college and at any time of life. A man should have the benefit of judicious guidance in the selection and arrangement of his studies, and be assisted over such difficulties as he may encounter. With such assistance—or, indeed, without it—an intelligent man can take up any study, at any time of life, and successfully learn what any man has learned.

A METHOD OF INSTRUCTION ESPECIALLY ADAPTED TO THE NEEDS OF THOSE LIVING IN ISOLATED LOCALITIES.

Especially Suited to the Farmer, Lumberman, Lighthouse Keeper, Soldier, Sailor, etc.

The correspondence method of instruction used by The International Correspondence Schools meets the requirements of farmers and their families, farm hands, young men and others in small villages having few educational advantages, planters, lumbermen, stock raisers, herders and drovers, miners, lighthouse keepers, soldiers, sailors and marines, postmasters, express agents, and others who desire to educate themselves, but by reason of the isolated localities in which they live or the nature of the business in which they are engaged, are prevented from attending school.

Students engaged in these lines of business are studying successfully by our correspondence system. Each student participates equally in the benefits of the Schools, no matter how much he is isolated from the others.

By Our Method the Student Does Not Require to See His Teacher.

The question is sometimes asked, "How can a man learn without seeing his teacher?" He does not require to see his teacher, for the teacher writes to him, if necessary, every day, giving detailed information by letter in full explanation of every difficulty he meets with in his lessons, and he learns from these and from his Instruction and Question Papers as well as if the teacher were present.

There is no fixed time for the sending of each set of papers by mail, but each student receives another installment of work when he has proven himself proficient in the one he has in hand, and the speed with which he gets through his Course depends upon his application to the work.

Proof that We Can Successfully Teach Those Living at a Great Distance.

That our Schools fully meet the wants of those living in isolated localities is proven by our large enrollment, which represents all parts of the civilized world. We have students in the mining camps of Alaska and the far West, in distant military posts, in the life-saving stations of the seacoast and the great lakes and other equally remote sections of the United States.

Students in All Parts of the World.

The Schools have many students in foreign lands. In South America, Europe, Asia, Africa, Australia, Tasmania, and the Hawaiian Islands; wherever the mails go, The International Correspondence Schools are furnishing instruction to many who live in such isolated localities that they could not educate themselves in any other way. See page 16.

Students in Far Away Mining Camps Represented.

A student, whose home is about ten thousand miles from Scranton, writes, "Your methods are thorough and are conducive to pleasure as well as knowledge. It is a great advantage to be able to correspond on subjects in which one is desirous of improving." Another writes from a South African mining camp, "I feel that you have an interest in each of your students, and cannot speak too highly of your method of instruction by mail."

Many Students in the U. S. Navy.

Many students of the Schools in the United States Navy are studying as successfully on shipboard as if they were ashore. Although the men-of-war to which they are attached are sent to all parts of the world, the postal service, through the United States Consulates, enables them to keep in touch with the Instructor, and they receive the same careful attention as their fellow-students on land.

KEYS TO QUESTION PAPERS.

Special Helps.

To aid students who live at such great distance from Scranton that the time occupied in sending for and receiving special instruction is unreasonably long ; and those whose time, for various reasons, is too limited to enable them to devote more than a few hours each week to study, and others who, for various reasons, would otherwise make slow progress, we have prepared Keys to the Question Papers in nearly all the subjects we teach.

Not Furnished as Part of the Regular Courses.

The price for each Key is 50 cents—*i.e.*, 50 cents for a Key to all the Question Papers in arithmetic, etc. The Keys are not furnished with the Instruction and Question Papers as part of a regular course, as it is not intended that they should be used except by those who find it difficult to work without them, but if employed judiciously they can be made to save both time and labor without injury to the student.

How to Use the Keys.

The correct way to use Keys is to refer to them only when you feel you cannot master the problems in hand without consuming too much time. Even then they should, except in rare cases, be used only to enable you to grasp the principles underlying the problems. They are merely intended for service in those emergencies when the student feels that he must have help on some particular points, and does not wish to wait until he can write to and receive a letter from us regarding them. Those who purchase Keys will do well to bear these directions in mind, as, unless the student is well grounded in the preliminary subjects, he will have difficulty in passing his final examination to secure his Diploma.

They are Not a Necessity.

The Keys are not a necessity, but merely a convenience for the classes of students mentioned, as all the information they contain will be furnished to the students free of charge from time to time as they may write for it.

REQUIREMENTS FOR ADMISSION.

No Preparation Needed Except Ability to Read and Write.

To enroll it is not necessary that the students have any previous knowledge of arithmetic or of any of the subjects in the different courses, as *we teach everything from the beginning*. This is one reason of the success of the Schools. Our Instruction Papers are thorough because they bring all subjects up to date, and give the best ideas of the ablest writers. Unlike text-books, they are also thorough because *they take up every subject from the beginning*. *Thorough in both ways.*

The qualifications necessary to become a student are few. To enable any person to enter the School it is only necessary that he be able to read and write in the English language. With this preparation we can teach arithmetic or drawing, and afterward, in order, algebra, geometry, and trigonometry, and the more advanced subjects.

RULES FOR ENROLLING.

Application Form. Every student on enrolling must sign an application form which will be supplied to him. In this application he binds himself to treat as confidential the Instruction and Question Papers furnished by the School, and not to divulge their contents to any person not a holder of a similar Scholarship, under penalty of forfeiture of the Scholarship. Treating the papers as confidential means that only the student in whose name the Scholarship is made out shall use them to study from.

We do not object to students showing Instruction or Question Papers, either for the purpose of obtaining assistance from others, or giving information regarding our method of instruction.

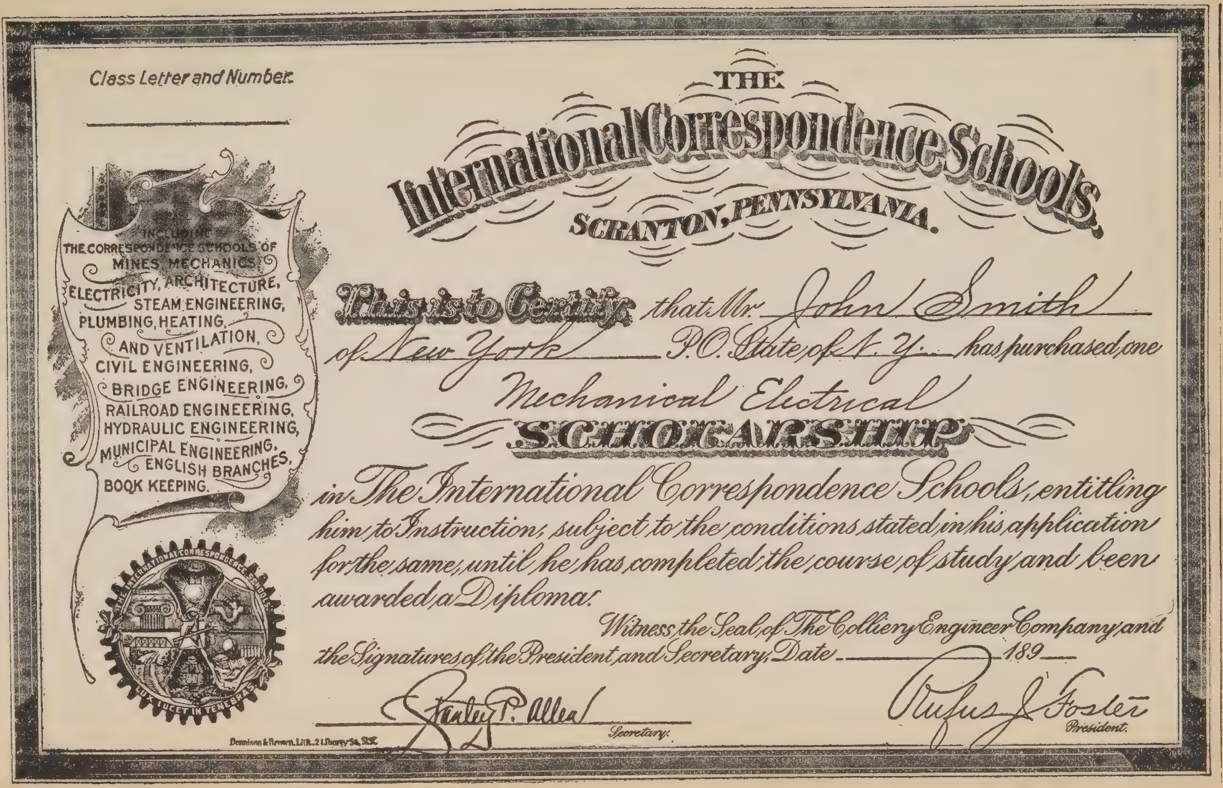
How to Enroll. To enroll, it is only necessary to fill out the application form and send it to us with the full price of the Scholarship, if you desire to pay in advance, or the first payment if you prefer to pay in installments, and immediately upon receipt of the application properly filled out, accompanied by the money, you will be enrolled as a student and your first work forwarded to you.

Persons May Join at Any Time. Students may enroll at any time, the only qualification required is ability to read and write, and the only thing necessary to succeed is study. All the subjects we advertise to teach are taught by us with great success.

No reduction in the price of Scholarships is made because the person wishing to enroll is already well informed in one or more of the subjects of the course in which he desires to enroll.

Certificates of Scholarship are Agreements to Give Instruction Until Student is Proficient. We issue to every person who purchases a Scholarship in The International Correspondence Schools, *as soon as we receive full payment*, a Scholarship Certificate similar to that illustrated on the next page. These Certificates are agreements to give instruction to the student until he is proficient in the branches included in his Scholarship, and has received his Diploma, no matter how long it may take. He can study when and where he pleases, so that if it is not convenient for him to do the work this year, he can do it next year or the year after. He is thus protected from loss through demands upon his time unforeseen at the time of his enrollment.

Why You Should Enroll Immediately. If you are thinking of learning to draw or of studying the theory of your trade, or of preparing yourself to engage in some of the trades or professions the theory of which we teach, do not put the matter off. Enroll without delay. If you postpone for six months commencing to study, it will be just that much longer before you will profit by your education. If you do not make a decision now, you may not do so at all. Procrastination may result in great loss to you, because in this country, in this age of invention, industrial progress, and rapid increase of wealth, every man blessed with good health and a fair technical education can safely calculate upon achieving business success.



Class Letter and Number.

INCLUDING
THE CORRESPONDENCE SCHOOLS OF
MINES, MECHANICS,
ELECTRICITY, ARCHITECTURE,
STEAM ENGINEERING,
PLUMBING, HEATING,
AND VENTILATION,
CIVIL ENGINEERING,
BRIDGE ENGINEERING,
RAILROAD ENGINEERING,
HYDRAULIC ENGINEERING,
MUNICIPAL ENGINEERING,
ENGLISH BRANCHES,
BOOK KEEPING.

THE
International Correspondence Schools,
SCRANTON, PENNSYLVANIA.

This is to Certify that Mr. John Smith of New York P.O. State of N. Y. has purchased one Mechanical Electrical

SCHOLARSHIP

in The International Correspondence Schools, entitling him to Instruction, subject to the conditions stated in his application for the same, until he has completed the course of study and been awarded a Diploma.

Witness the Seal of The Colliery Engineer Company and the Signatures of the President and Secretary, Date ______ 189__

Stanley P. Allen
Secretary.

Rufus J. Foster
President.

We do not cancel Scholarships or refund money paid for them.

Scholarships Transferable.

It is understood that if at any time a student desires to stop studying he has the right to sell his Scholarship or give it to some other person, and that it is transferable.

ORDER OF WORK.

Drawing May be Taken in Connection with Other Studies.

Students are required to take up and complete their studies in the order given in the schedule of studies in the Circulars of Information, except that they can take up Drawing in connection with the other work. When there are good reasons for departing from this rule the Principal gives the student permission to do so. We find from experience that it is best for students to do the work in regular order; even if they are well informed in some of the subjects when they commence, a review is always advantageous.

Instruction and Question Papers and Drawing Plates are not sold or furnished to any except those receiving instruction in accordance with the plan of the School.

THE EXPENSES CONNECTED WITH A COURSE.

An Education Within the Reach of All.

The cost of education in our Schools is much less than similar instruction can be obtained elsewhere in the world. It is so small that even the most indigent can hope sometimes to be in a position to study with us.

To obtain a technical education in a regular school or college costs a sum which to the majority of people is a small fortune. It includes board for three or four years, and is so great that 99 per cent of those who would be benefited by technical education and who are anxious to get it, can never hope to command it for the purpose.

Only Four Items of Expenditure.

In our Schools the expenses other than the prices of the Scholarships are limited to the cost of paper on which to write the answers to the questions, the postage to send these answers to the Schools, and the price of a few drawing instruments.

THE PRICES OF SCHOLARSHIPS.

The Courses Cheap at Ten Times the Price.

The prices of Scholarships range from $18 to $50, according to the number of subjects and the expense in teaching them in the different Courses. They are cheap at ten times the price asked, but are purposely made low because the classes whom the Schools are intended to reach cannot pay more. The cost of a Scholarship in The International Correspondence Schools is even less than the cost of the text-books which a student must have in pursuing the same studies in a regular technical school.

Payment May be Made by Installments.

For the convenience of those who wish to pay for the Scholarships in small amounts, we accept payment in monthly installments, and *it is understood that when Scholarships are purchased on the installment plan, they are not forfeitable for*

Scholarships Not Forfeited for Failure to Meet the Payments Promptly.

failure to pay the installments promptly, and that if the persons purchasing the same cannot pay their installments when they become due, upon a written request to the Manager they are to receive such extension of time as may be necessary.

Students in our Schools are not obliged to buy any books whatever. The Instruction Papers are complete text-books.

Every pupil who buys a Scholarship is entitled to the full benefits of the School until proficiency is gained in the subjects undertaken, and he has passed the final examination and obtained a Diploma or Certificate of Proficiency, no matter how long it may take him.

THE COST OF PAPER ON WHICH TO WRITE THE ANSWERS TO THE QUESTIONS.

Students Must Use Light Paper.

The student supplies himself with foolscap paper on which to do his work. As the price of the postage increases with the weight of the paper, it is advantageous alike to him and to ourselves for him to use as light paper as possible.

Prices of T. S. Co. Paper.

The Technical Supply Company, Scranton, Pa., will furnish good light linen paper, 13x8½ inches, at the following rates :

100	sheets by mail (postage paid)	$0.45
250	" " " " "	1.15
500	" " " " "	2.25
100	" " express (purchaser to pay expressage)	0.30
250	" " " " " "	0.80
500	" " " " " "	1.50

Students can order directly from them or through us, *but they are not required to do so.* If they buy elsewhere they are requested to buy light paper of good quality, as it makes a considerable difference in the postage.

THE COST OF THE DRAWING INSTRUMENTS AND MATERIALS.

Prices of Outfits.

Unless they already have similar instruments, students in our technical courses, excepting the Prospecting Course of The Correspondence School of Mines, need a Drawing Outfit such as is described in our Circulars of Information. The outfits range in price from $5.00 to $10.90. The goods comprising them are of good quality, and the prices given are lower than they can be bought for from retailers of such goods.

Articles Sold Separately.

As it is not always convenient for students to buy a complete outfit, each article is sold separately at the price given in the schedule of the outfit, and will be sent on receipt of the price, with the postage paid.

May be Purchased Elsewhere.

Students are not required to purchase these goods of The Technical Supply Company or through us. They can buy them where they see fit. But intending purchasers will find that both in price and quality The Technical Supply Compan can do better than local dealers.

THE POSTAGE TO SEND THE ANSWERS TO THE SCHOOL.

The work of the students is sent to us in sealed envelopes (which we furnish) as "first-class mail matter," the rate for which is two cents for each ounce or fraction thereof, prepaid. It is a violation of the postal laws to send it as "third-class matter."

Average Cost for Postage.

The postage bill of the average student is about one-tenth of the price of his Scholarship, or from $2 to $5 for the Course.

The School pays the postage on the Instruction and Question Papers, Drawing Plates, and all other communications sent to the student, and furnishes him with envelopes and information blanks free of charge.

DIPLOMAS AND CERTIFICATES OF PROFICIENCY.

What the Diplomas Are.

Diplomas and Certificates of Proficiency are issued to students completing all the subjects of the courses who pass the final examination. These Diplomas and Certificates are the legally authenticated declarations of the Instructors of the Schools that the holders thereof have successfully completed the study of the subjects named, and have satisfied them of their proficiency therein. They do not carry with them degrees.

How Granted.

They are granted on final examination papers answered by the student after he has completed his studies, before a witness appointed by the Principal, if he considers it necessary to appoint one. The student's answers to the final examination papers become the property of the Schools, and will not be returned.

High Standard Maintained.

A high standard is maintained for the Diplomas and Certificates of Proficiency of The International Correspondence Schools by only issuing them to those who have faithfully passed through the courses and proved by the final examination that they are entitled to possess them.

The Final Examination.

We do not bind ourselves in our Scholarship Certificate to give a Diploma or Certificate of Proficiency when the student has passed through all the subjects of a particular course of study, but we do bind ourselves to instruct until the student is qualified to receive the Diploma or Certificate. If a student after completing a course is found, on final examination, not to understand the subjects well enough to qualify him to receive a Diploma or Certificate, he is required to review the whole course or the branches in which he is deficient, and he is kept reviewing until he satisfies the Instructors that he has a good knowledge of all the subjects in the course.

Under no circumstances are they issued to undeserving persons, so that to hold one is of itself evidence that the holder has been a faithful student and possesses the education claimed.

THE CORRESPONDENCE SCHOOL OF ELECTRICITY.

ELECTRICAL INDUSTRIES, THEIR DEVELOPMENT AND THE OPPORTUNITIES THEY OFFER AMBITIOUS MEN.

Electrical Science.

It may be truthfully said that electricity is the wonder of the age, but the idea that it is a mysterious science, with which only wizards and people of extraordinary ability can deal, is incorrect.

Many of its Laws Established.

As a science it is not in its infancy. Many of its laws are as well determined as those in any other science, not even excepting astronomy. That electrical action is but a manifestation of energy is well established. Like other forms of energy, all of its actions are but the results of a force overcoming a resistance or attempting to overcome it. The old theory that electricity is a fluid, or two fluids, etc., is no longer tenable, but it is rather a condition into which substances are thrown, and of which all substances more or less partake, just as, for instance, all bodies contain heat, and may be still further heated, some to higher temperatures than others. Moreover, as a superheated body tends to transmit its excess of heat to surrounding bodies by the medium best adapted for such transmission, so a body supercharged with electricity tends, by the most available medium, to transmit its excess of electric potential to substances having less. This transmission is called the electric current. The substances which offer the least resistance to it are called conductors, and those which offer the most, non-conductors. Furthermore, as weights are expressed in pounds and ounces, or time in minutes and seconds, or distances in feet and inches, so the difference of electric potential between two bodies, or the electromotive force (E. M. F.) is expressed in volts, the rate of transmission of electricity, in amperes, and the resistance offered to the current by the conducting material, in ohms.

Some of its Manifestations.

May be Successfully Studied.

Upon facts such as these the science of electricity rests, and a knowledge of them robs the subject of its mystery and makes possible intelligent investigation and successful application by men of ordinary ability.

Its Rapid Development.

The rapid progress in the application of electricity in useful forms of energy entitles it to all the interest it has called forth. In a comparatively few years the science has developed into one of the largest industries in the country, giving employment directly or indirectly to 2,500,000 people, and representing an invested capital of about $1,500,000,000.

To-day it is almost impossible to enumerate the services electricity is performing in the various departments of human endeavor, and no thoughtful man will attempt to define limits beyond which, in the advancement of civilization and the promotion of man's material welfare, it will not pass.

BEGINNINGS OF THE INDUSTRIES.

The Telegraph.

The first generally useful application of electricity was the telegraph. With this instrument, within the memory of men now living, instantaneous communication between long distances was first made practicable. The manufacture and operation of the telegraph were the earliest electrical industries, and for many years have given employment to thousands of people. The telegraph system of the United States has a capitalization of $200,000,000.

Although there have been many improvements in telegraphy within recent years, such as the inventions which enable operators on board trains to send and receive messages while the trains are in motion, or those which make it possible to send three or four messages over the same wire at the same time, yet the inroads which have been made in its business by the long-distance telephone within the past year or two have been so serious that it has been unable to do more than hold its own.

As we go to press, however, we observe an article on the editorial page of one of the leading electrical papers, entitled "What We are Coming to in Telegraphy," which, if it be true, may again make the telegraph, as it once was, the wonder of the world. We print the article, without investigation, for what it is worth :

" With a view to ascertaining the highest speed at which telegraphic characters can be legibly recorded, Mr. P. B. Delany, in some recent experiments, succeeded in transmitting by his machine system 8000 words per minute, and obtained a plain reproduction of the signals by electrolysis on the chemically prepared receiving tape. The circuit was an artificial one of 650 ohms, 2.95 microfarads, and the electromotive force was 115 volts. This is about the equivalent of an ordinary telegraph line of 100 miles in length, or, say, New York to Philadelphia. At this speed the perforated tape, upon which the messages were composed, passed through the transmitting machine at the rate of 27½ feet per second, and the impulses comprising the letters traveled at the rate of 2500 per second, or 133 words, equal to six ordinary telegrams of 22 words each, in a single second. At this rate the next few years must bring about great changes in methods of correspondence, and, inevitably, a large portion of the ninety millions now annually expended on wheel transportation of the mails will be diverted to the telegraph. Why not ?"

The Telephone.

The invention of the telephone was another step forward, more wonderful, even, than that of the telegraph. Within a very few years after its discovery it developed from a lecture-room toy into an industry employing many thousands of people. Over a half million telephones were in use in the United States in 1893, and it is estimated that in that year about six hundred and fifty million conversations took place over them. In 1894 the investments in telephony amounted to $77,500,000. The patronage of the telephone companies continued to increase without an appreciable halt during periods of the worst business depression, and at the present time is growing more rapidly than ever before. For all practical purposes the entire section of the United States east of the Mississippi River is now one vast telephone exchange, and conversations between points 1500 miles apart are matters of daily occurrence. In November, 1896, the long-distance telephone company obtained election returns from distant States and posted its bulletins from 20 to 30 minutes sooner than it was possible for the telegraph companies to handle the same news. One of the most recent improvements in local telephony is an automatic telephone exchange which makes it possible for subscribers to talk with each other without the intervention of the central office.

Electric Lighting.

Between the discovery of the telegraph and telephone came great improvements in apparatus for developing electrical energy. This stimulated invention, and applications of electricity and electrical industries grew with marvelous rapidity. One of the first exhibitions of the electric light in America was at the Centennial Exhibition in 1876, where the exhibitor explained to those interested that the cost of producing it was so excessive as to prevent its use except for exhibition purposes. Within a year the electric light, sputtering and blinking, but according to the show bills, "Rivaling in brilliancy the noonday sun," was the star attraction of the country circus, and within two years the first commercial electric lights in America were installed in a park at Cleveland, Ohio. At about the same time the cities of Los Angeles, California, and Sunbury, Pennsylvania, abandoned gas illumination for their streets and adopted electricity instead.

Widespread Use.

Now, as a means of lighting, it is fast superseding all others. There are at present 2500 electric light companies in the United States and about 200 municipal plants. The central stations represent an invested capital of $300,000,000. In addition, there are about 7500 isolated plants, which have expended $200,000,000 more. An idea of the capacity of these 10,000 installations may be formed when it is known that there are produced daily for their use from 50,000 to 75,000 incandescent lamps, and that the annual consumption of carbons in arc lamps is 200,000,000. A single factory, in a Western city, for the manufacture of carbons for arc lights, occupies seventeen acres of ground. Arc lights are cheap and convenient to operate, and incandescent lamps may be had of any desired size, shape or color, and can be used in any place or position, exposed to high winds or submerged in water. The cost is so low that towns of 1000 inhabitants can afford this greatest of modern municipal luxuries. This is true of the United States, and of most European countries. Rome, the "eternal city," is furnished with light and power by electricity generated eighteen miles distant; Jerusalem, the "sacred city," is lighted by electricity, and Singapore, the capital of the Malay Peninsula, is illuminated in the same way. In Japan, in 1893, a dozen electric light companies owned property worth, in the aggregate, two and one half million dollars, and a like development has occurred in all parts of the world.

THE DEVELOPMENT OF ELECTRIC TRANSPORTATION.

Street Railways.

Probably the greatest revolution in any industry, due to electricity, has been in street railway traction, which had its first practical application in Scranton, Pa., the home of The International Correspondence Schools. In ten years street railways representing several thousand miles of track, formerly operated with horses and steam, were equipped with electric power.

In 1895 there were 900 electric railways in the United States, with 11,000 miles of track and 25,000 cars, and representing an invested capital of $750,000,000 This investment is being increased annually at the rate of $100,000,000. An interesting illustration of the extent to which electric transportation has developed is afforded by the fact that a German contractor is now building a trolley road ten miles long in Teheran, Persia.

It has been estimated that these railways are now doing the work of no less than 275,000 horses, thus decreasing the consumption of corn and oats by 45,000,000 bushels a year and lessening the tonnage of the railroad companies by an equal amount. They have solved the problem of relieving overcrowded cities of their surplus population. They provide cheap and quick transportation of farm produce from rural districts to points of consumption, and assist the Government in the delivery of mail. All the principal cities have electric mail cars which greatly improve the postal service in those communities.

Underground Roads.

Recent improvements indicate the commercial success of the underground trolley. In New York city the Lenox Avenue street car line is operated by an underground trolley. Electrical roads entirely underground are either in operation or are projected for Vienna, Berlin, London, Paris, Buda-Pesth and New York.

Electric Locomotives.

Electricity has many advantages which make it a superior motive power. Large electric locomotives are operated in places where steam locomotives are prohibited on account of smoke, or for other reasons. Locomotives for freight haulage have been in use since 1892. The Baltimore & Ohio Railroad Company employs such locomotives to transfer trains through its five-mile tunnel under the city of Baltimore with the greatest success. At tests of these locomotives made recently, they developed speeds of 80 miles per hour, and their work in starting the heaviest freight trains compared favorably with that of the most powerful steam locomotives.

Application to Steam Railroads.

The electric locomotive is on trial, and with the most pronounced success it must be some time before electricity supplants steam in regular freight and passenger traffic, but with the history of the telegraph, telephone, trolley, and electric light fresh in memory, careful men are slow in predicting it will not supplant the steam locomotive. In Liverpool and Chicago the elevated railroads have for some time been operated with electricity, and the New York elevated roads will probably be soon. Electric roads of fifty or more miles in length are in operation in various parts of the country, and the extension of these systems into trunk lines will soon take place as a matter of course. Electric roads parallel the steam roads all the way from New York to Boston, and in some localities more than one half of the passenger traffic has been diverted to the electric lines. Branches of the New York, New Haven & Hartford, New York Central, Pennsylvania, Cincinnati, Hamilton & Dayton, Louisville & New Albany and other roads are being equipped with electric power, and trains are required to develop speeds of 45 or more miles per hour.

Detailed calculations have been made by experienced engineers which go to show that the adoption of electricity as the motive power of all trains on one of the leading railroad systems of America would mean a saving to that system, in operating expenses alone, of not less than $6,000,000 annually. If this be true, the change of motive power from steam to electricity is sure to take place within a few years.

Street Carriages.

Electric coaches or carriages capable of holding a number of persons are in use on the streets of Boston and elsewhere, and have demonstrated their ability to run at rapid speeds. They are admirably adapted for city use, and it is confidently expected by the Electric Storage Battery Company that within a very short time their vehicles will be running regularly in the avenues and parks of all the large cities.

Mine Haulage, etc.

In mine haulage electric locomotives are meeting with exceptional success, and this is only one of the many successful applications to mining. Electric drills, coal-cutting machinery, lights and other appliances have so increased within the past few years that in 1896 it was estimated electric investments in mining plants had reached a total of $100,000,000.

Launches and Ferryboats.

The development of the use of electricity on water has kept pace with that on land. The success of the electric launches which carried thousands of people at the World's Fair has given rise to a great variety of boats similarly propelled, and in one city of Europe a line of eight electric ferry-boats is in use.

Electric Towing.

The prospects are encouraging for the successful application of electricity to canal haulage. Electric towing has been done experimentally on canals in New York, New Jersey, France, and elsewhere, and the results in New York are so promising that the Legislature authorized the formation of a company to construct a system for propelling the boats on the Erie Canal. It is stated that electric tow boats are about to be placed on the river Spree, near Berlin, where, for a distance of eight miles, the ordinary barges cannot use sails, owing to the large number of low bridges.

On Shipboard. The first electric machinery ever placed in a steamboat was that put in the "Columbia" of San Francisco in 1880. To-day, there is not a first-class steam vessel in the world that does not have its electric plant. On ship-board, the advantages of the motor over the steam engine for working capstans, windlasses, pumps and steering gears are many. The first cost of long steam-pipes, their waste from condensation and their liability to accident render them much less desirable than flexible wires for the transmission of motive force throughout the ship. Electricity is daily coming into more general use on ship-board.

ELECTRIC POWER TRANSMISSION.

Convenience. For power transmission, electricity is all that can reasonably be desired. A large station fitted with the most economical type of engines, favorably situated with regard to fuel supply and water, can generate power and convert it into electricity which can be distributed wherever desired, thus providing a source of power almost ideal in safety and simplicity, for by the pressure of a finger, machinery can be started or stopped, etc., without the trouble of dirt, coal, ashes, or attendance at the point of use. Perfected, this convenience of power transmission may enable much of the work done by the mechanic at the factory to be performed at home.

Economy in Connection with Water Power. In connection with water power, the usefulness and economy of electrical power transmission is very great. Water power is, of itself, portable in only a very limited sense, and then only at a very heavy outlay for canals and canal maintenance ; but it has been utilized by mankind from the earliest times, and manufacturing communities in all ages have built in unhealthy, inaccessible, inconvenient localities in order that they might be near the source of cheap power. Electric power transmission has so changed the conditions that they can locate now wherever they wish.

Utilization of Water Falls and Ocean and River Currents. There are many installations for the generation of hundreds of horse power to be used at distances of ten and fifteen miles. The city of Fresno, California (15,000 population), is lighted and furnished with an abundance of power from a station located 35 miles away. So far as the cost of light and power is concerned, it is on a par with any city in the United States. About 10,000 horse-power of electrical energy is now transmitted continuously from Niagara Falls to Buffalo, a distance of 26 miles. This amount is being rapidly increased, and will eventually make Western New York one of the greatest manufacturing centers of the world.

Within the last few years the transmission of power over one hundred miles was successfully accomplished in Europe, and in May, 1896, about one-thirtieth of a horse-power was transmitted from Niagara Falls to the Electrical Exposition then being held in New York City, a distance of 453 miles. The current was carried on two wires which form a part of the Western Union Telegraph Company's regular system between Niagara Falls and New York.

By making a dam or roadway 100 feet in width and 14 miles long it is proposed to connect Ireland and Scotland at a point where the ocean current is very strong. Frequent power stations are to be located and the enormous force now going to waste is to be changed into electrical energy, and by means of copper bars transmitted to the homes and factories of the surrounding cities. A dam embodying the same general features is projected across the Niagara River at Buffalo.

Profitable Use of Coal Waste.

In the City of Scranton, the home of The International Correspondence Schools, by using culm or coal dirt, which is the refuse produced in cleaning and preparing anthracite coal and is worth, delivered at the boilers, about 25 cents per ton, steam power is developed at a phenomenally low cost, and it is proposed to construct gigantic plants to transform the energy of this refuse into electric power and then distribute it.

Tesla's Prediction.

The prophecy is made by Nikola Tesla, an electrical engineer of world-wide reputation, that the day will soon come when it will be possible to transmit electric power from one station to another without connecting wires. The far-reaching possibilities in this prediction will be appreciated by every intelligent man, and should inspire young men of ability to fit themselves for a profession which is bound, sooner or later, to exercise a dominating influence in nearly every department of the world's work.

RECENT APPLICATIONS AND POSSIBLE DEVELOPMENTS.

Improvement in Lighting.

The researches of Nikola Tesla in the field of high frequency alternating currents show the possibility of electric lighting by methods vastly more efficient than those now in use, and it is possible that the sources of light can be spread out over large surfaces and be made to cover walls and ceilings, etc.

On May 20th, 1896, tests were made by some members of the American Institute of Electrical Engineers which bore out the claims of Mr. D. McFarland Moore that he was able to produce brilliant light in vaccum tubes at very small expense. At that time he lighted their hall with 27 of his vacuum tubes, so that colors could be distinguished and fine print was legible. This was done at a low voltage and without any of the expensive apparatus which had hitherto been regarded as necessary for the production of such light.

Heating.

Electricity is coming to the front as a heating agent. There is no grate to burn out, or steam or water to leak and rust. The radiators are simple and durable, offer a large radiating surface, are so constructed that they cannot overheat the rooms, and they radiate the heat freely. They work safely without attention, and their adoption in some of the public buildings of London and other cities presages their more general use. Electrical Engineers suggest the practicability of warming the houses in extensive districts by power transmitted from central stations. Electric power is also used to produce cooling effects, and in time public and private buildings may be maintained at desired temperatures throughout the year by this wonderful agent.

Cooking.

It has been demonstrated that cooking by electricity is cheaper than by coal. It is more cleanly, the heat can be applied at any point and raised to any temperature, and the kitchen can be kept cool.

Motors and Cranes.

It is estimated that there are in use in the United States 500,000 electric motors, employed in several hundred different industries. In large machine shops they are used for operating the hoisting and traveling mechanisms of cranes, and for running line shafting and individual machines, such as planers, lathes, drills, slotters, etc. In foundries the ladles and slag are lifted, carried and lowered by electric cranes. In steel works ingots are lifted and handled, and rails are straightened by it.

Welding.

Electric welding is used in wire mills to make the product of desired lengths. It is also employed for making continuous rail for street railroads by welding the 30 foot sections together after they are in place, for pipe welding in making continuous coils for heaters, and for many other purposes. Large cloth printing mills use electricity to run their printing presses, and its use is daily becoming more general for running the machinery in printing offices.

Elevators.

Electric elevators have supplanted many operated by hydraulic power, steam and compressed air, and the results, in satisfactory working, safety and economy of operation, are claimed to be much better.

Purification of Sewage and Garbage.

The free chlorine and other powerful disinfectants which result from the decomposition of seawater by the electric current afford a simple and inexpensive method of effectually deodorizing sewage and garbage, which has been put into successful practice in France and this country. If the foulest liquids can be made odorless and harmless by a swift and inexpensive method, one of the most troublesome of municipal and sanitary problems will have been solved.

Other Uses.

Plants for the electrical treatment of ores are in successful operation, and there is hardly a field of human endeavor which electricity has not invaded. Railroads are using it for destroying weeds ; farmers are coming to look to it as a substitute for other forms of power in much of the farm work ; ranchers use it for branding cattle ; barbers for cutting hair, and governments for executing criminals. By the photophone we are able to transmit shadows and paint silhouettes, and may soon be able to take photographs at great distances. The discovery of the "X" or "Roentgen" rays and their use in medicine and the arts are too well known to require description. It is believed that by means of these rays a way may eventually be found to help the blind to see.

Growth of the Electrical Supply Business.

In every line of electrical industry the progress is so rapid as to cause those in touch with the subject to watch it with astonishment. Twenty-five years ago the electrical supply houses in the United States could be counted upon the fingers of a single hand. To-day there are thousands of such houses transacting millions of dollars worth of business annually,

A GREAT FIELD FOR ENERGETIC WORKERS.

Responsible Positions.

From the facts stated the ambitious worker cannot fail to see that the field of electricity is limitless and that the growth of electrical industries has but begun. The possibilities are so numerous and varied as to make the outlook for the future brighter than in any other line of work. Its growth for many years must be great. Who will fill the responsible positions resulting from this development? They must be men of practical experience and technical education. *They will be men who grasp every opportunity for knowledge and are willing to utilize their evenings and spare moments to educate themselves.*

Need of Educated Men.

There is a constant advancement in the standard of knowledge required of men employed about electrical machinery. Every year improvement is made and only such as understand the principles of electricity and mechanics can keep pace with the advancement. It is admitted in every electrical industry that it is useless to hope to attain the top notch of success unless men are employed who are qualified to improve old designs, make inventions and perfect methods of manufacture or service so as to merit the approval of the best class of consumers.

Opportunities for Employment.

Good situations open up every day. Many more competent men than are available will be needed in the near future as officials, engineers, superintendents, contractors, foremen, draughtsmen, test officers, managers of telephone exchanges, armature-winders, magnet-winders, wire-braiders, repairers, line-men, wire-men, dynamo-tenders, motor-men, electric signal men, etc. There are not enough educated men now in these industries to supply the demand which is certain to arise, and it will be filled by those now employed in industries soon to be largely superseded by electricity, who have the foresight to prepare themselves for the change. Now is the time to study and lay the foundation on which to build a new occupation.

Now is the Time to Prepare for Them.

With the education which can be obtained in the electrical courses of this School men will have little difficulty in securing remunerative positions in some branch of the great industry, and when once a foothold is obtained their chances for advancement will be far better than those of persons not so well informed in the principles of the science.

Two Great Classes of Electrical Workers.

The field in which electrical workers are laboring may be considered under two heads.

First: Those engaged in designing and manufacturing electrical machinery and appliances.

Second: Those engaged in using the same.

Few persons are engaged in both of these two great branches, hence although technical instruction intended to qualify men for either of them must embrace many subjects, such as Mathematics, Physics, and the principles of electricity in common, yet in either branch there is much instruction needed which those in the other branch do not require, and in the education of busy men who have little time to study, everything should be omitted which is not absolutely necessary for them to know.

This idea has been kept in mind in the arrangement of our electrical courses. For the former class our Mechanical-Electrical Course has been prepared; for the latter our Electrical Power and Lighting Course.

OUR COURSE FOR THOSE WHO WISH TO LEARN TO DESIGN ELECTRICAL MACHINERY.

Mechanical-Electrical Scholarship.

Our Mechanical-Electrical Scholarship includes instruction in all the subjects of our popular Complete Mechanical Course, together with all the electrical instruction of The Correspondence School of Electricity. It is intended for those wishing complete instruction in mechanical and electrical engineering, and particularly for those desiring to become designers of electrical machinery. The subjects are taught in the following order: arithmetic, algebra, geometry and trigonometry, elementary mechanics, hydromechanics, pneumatics, heat, mechanical drawing, steam and steam engines, strength of materials, applied mechanics, boilers, machine design, fundamental principles of electricity and appendix, electrical measurements and appendix, batteries, applied electricity, dynamo-electric machine design, power transmission.

Why We Give Electrical Designers Thorough Instruction in Mechanics and Mechanical Drawing.

There is no getting away from the fact that a first-class designer of electrical machinery must have a thorough mechanical education. The strength of parts must never be sacrificed to magnetic action. It is quite as essential that electrical machinery should be designed in conformity with the principles of kinematics as any other class of machinery. Electrical designing requires a knowledge of all the principles underlying mechanics, and of the details and economies of machine design, steam engineering, etc. The designer must be able to draw. Drawing is "The shorthand language of modern science," "The language of construction and the medium through which men execute." The Electrical Engineer who cannot make and read a mechanical drawing is as well qualified for his work as a book-keeper who cannot write.

Particular Attention Paid to Preparatory Studies.

In our Mechanical-Electrical Course a great deal of attention is paid to preparatory studies. This is because it is impossible for the student who wishes to qualify himself to design electrical machinery to do so without this preparatory education. It is because nine out of every ten would-be designers are deficient in this respect that they meet with such poor success in their efforts and make so little progress in learning from text-books. It is because we *insist* that our students prepare themselves in arithmetic before they undertake algebra, and in algebra before they undertake geometry and trigonometry, and in mechanics and other related subjects before they take up machine design that we are so successful in correspondence instruction. Our course, however, gives the electrical designer only what he needs to know. It does not burden him with calculus and other subjects which will take time for him to learn and which he can do without.

WHY THE CONSULTING ENGINEER SHOULD TAKE IT.

His Duties.

The Consulting Engineer, who has to deal with the design for the entire plant, should take our Mechanical-Electrical Scholarship in order that he may be thoroughly qualified to fill the duties of his important position. He must understand the design of electrical and other machinery so thoroughly that he can readily decide from a drawing whether a machine will do the work required. And since it is his duty to report upon the work of designers, it follows that to him, even more than to those who have to do exclusively with the manufacture of electrical apparatus, a complete knowledge of dynamo-electric machine design is of the utmost importance.

EDUCATIONAL NEEDS OF SUPERINTENDENTS AND FOREMEN OF ELECTRICAL ESTABLISHMENTS.

Superintendents Must Understand Kinematics, Drawing and Dynamo-Electric Machine Design.

Superintendents of electrical establishments should educate themselves in the construction and operation of machines. The same mechanical laws operate throughout the universe. Newton's three laws of motion may be employed to determine the movements of the smallest watch or of the stars. A knowledge of mechanical drawing enables its possessor to read drawings and to put on paper ideas that may occur to him. Understanding kinematics, and dynamo-electric machine design, the superintendent of an electrical establishment may improve the design of a machine from the drawings without going to the expense of constructing it and learning its good and bad points from actual working.

Shop Foremen Should Have the Same Knowledge.

Foremen of shops where electrical instruments and apparatus are manufactured should qualify themselves to be of as much assistance as possible. Most shops work to drawings only, and foremen must understand mechanical drawing. Our Instruction Papers on applied mechanics, machine design, strength of materials, dynamo-electric machine design, etc., will enable foremen to locate errors that escape designers. For example, certain connections in a proposed machine may seem to the foreman to be of insufficient section to carry the necessary current. If he lacks the knowledge to prove the fact, he must let it go ; if, however, he can prove to his employer that his ideas are correct he saves them money and reputation, and paves the way for his own advancement.

Needed by Foremen of Winding Departments.

Our Mechanical-Electrical Course is especially adapted to the requirements of foremen of winding departments in large electrical factories. It gives them an understanding of the work under their charge, and enables them to use their own judgment in cases where time and money is lost if they are obliged to refer to others. The winding is one of the most vital operations in the construction of dynamo-electric machinery—the smallest mistake in insulating or connecting may cause any amount of trouble.

As foremen are responsible for the work turned out by their departments, it is essential that they understand the nature of the work which the machines are intended to perform. They should be qualified to answer all questions asked by the winders and should be familiar with all methods of winding and connecting, so as to be able to instruct their men.

Will Qualify Foremen of Testing Departments.

Foremen of testing departments should take our Mechanical-Electrical Course. Many of them have obtained the knowledge to qualify them for their positions entirely by observation, by seeing how this or that thing is done or works. They are sufficiently acquainted with one line of testing to take charge of it, if nothing happens out of the usual order, but when something occurs which requires a knowledge of the principles of the force they are handling, they are apt to lose presence of mind. Grave consequences have resulted from such ignorance. Our Mechanical-Electrical Course will prepare these men to successfully cope with any conditions likely to arise in the conduct of the work under their charge.

THE WAY TO PROMOTION FOR ARMATURE AND MAGNET WINDERS AND OTHER ELECTRICAL FACTORY ARTISANS.

Practice Alone Insufficient.

Armature and magnet winders should take the course. The winding of armatures and magnets is now a general occupation and called a "trade" in the full meaning of the word. When a young man enters an electrical establishment to learn armature winding, he is made a "helper" where he works until he learns how to wind armatures himself. It sometimes takes months to do this. Even then he is not, as a rule, fitted for all kinds of work. A thorough knowledge of his trade cannot be obtained from the experience he gets in a large factory, because he is kept winding or repairing one kind of armature. When he is fortunate enough to have varied work, he accumulates knowledge slowly; because his mind has not the training to understand and grasp all that he sees. Shop experience, however, combined with a knowledge of the principles of electricity will make winders independent of their special line of work and enable them to become foremen or to leave the winding room to occupy positions of more responsibility.

Must Study to Obtain Promotion.

Wire-braiders, lamp-makers and those engaged in exhausting and testing incandescent lamps and electrical factory operatives and workers in general should take our Mechanical-Electrical Course because it is the road to advancement. Repairers of electrical machinery and apparatus should take it in order that their work may be done in a scientific manner.

CIVIL AND OTHER ENGINEERS SHOULD STUDY ELECTRICAL ENGINEERING.

Electricity has Invaded all Branches of Engineering.

Such rapid progress has been made in the application of electricity that civil, hydraulic, railroad, bridge, sanitary, architectural, municipal, and mining engineers cannot afford to be without a knowledge of its principles.

A knowledge of electricity is an absolute necessity to many engineers because of the important part it is playing in all departments of engineering. Men who are engaged in these professions should take our Mechanical-Electrical Course. If they have spare moments they can use them to qualify to obtain part of the rich harvest which will be gathered by electrical engineers in the next decade. Engineers who are without such knowledge are handicapped on every side.

AN OPPORTUNITY FOR DRAUGHTSMEN.

Can Become Engineers or Superintendents.

Our Mechanical Electrical Course offers an excellent opportunity for draughtsmen employed in mechanical or electrical industries to rise higher. They can qualify to design both mechanical and electrical machinery. The draughtsman who has obtained our Mechanical-Electrical Diploma has taken a long stride toward the position of designing engineer or superintendent. A year of experience, with his spare time spent in reading the literature of his profession, should fit him for any position in the mechanical or electrical engineering professions.

AN ATTRACTIVE FIELD FOR MACHINISTS AND INVENTORS.

Importance of a Knowledge of Mechanics and Mechanical Drawing.

One of the most attractive fields for machinists is electricity. Machinists, as a rule, are an intelligent, ambitious class of men and desire to rise to positions of eminence in the engineering world. This is a laudable ambition. To attain it the practical experience which they already have will be of great assistance. Graduates of the best technical colleges frequently enter machine shops and work for almost nothing in order to obtain this practical experience. But the machinist must have something more than experience ; he must be educated. The first thing to acquire is a knowledge of mechanics and mechanical drawing, and both of these subjects are included in our Mechanical-Electrical Course.

Inventors Require to be Educated.

Many machinists are inventors. Many of their inventions are valuable and many are worthless because the inventors are ignorant of mechanical principles. We recall seeing recently in a technical journal, a description of a new slide valve which had just been patented. The cut showed an ordinary valve excepting that the back instead of being flat had the shape of an inverted V. The inventor claimed that the Λ-shaped back would reduce the steam pressure on the back of the valve, and do away with the necessity of "balancing." A knowledge of the principles of Hydrostatics would have saved him the time spent upon this so-called invention, and the money that it cost to patent it.

Cost of Ignorance.

Electricity is an especially hopeful field for the inventor, but the inventor to be successful must be educated in the principles of mechanics and electricity. Such an education acts upon a man as a spur and incentive to be original, to watch the mistakes of others that he may not make the same errors, and to improve his methods of work. It trains him to observe. Many an electrical enterprise, owing its origin to some new and entirely useful and practicable idea of an inventor, has been launched upon the sea of commercial enterprise, and has been shipwrecked because its promoters lacked the technical education necessary to develop the idea and get the best results from it. Other men, with less originality, but with better technical education have taken up the same idea, put it in practical shape and made money out of it.

Fitted to Obtain Full Benefit from New Ideas.

Any machinist or inventor who finishes our Mechanical-Electrical Scholarship will be qualified, as far as technical education is concerned, to obtain the greatest possible measure of success from ideas of practical value which may occur to him. Some conception of the rapidity with which practical inventions are utilized may be gathered from the fact that it was only in 1893 that the first induction motor was sold, and a year later they were in use in large numbers in all parts of the country.

OTHERS WHO WILL BE BENEFITED BY OUR MECHANICAL-ELECTRICAL SCHOLARSHIP.

Patent Lawyers, Manufacturers, Watchmakers, etc., etc., Can Take it to Advantage.

Lawyers who argue patent causes should take our Mechanical-Electrical Course to qualify them to conduct their cases. Scientific men, teachers and students in general will find it one of the most interesting and valuable courses of study they can take up. Superintendents and owners of manufacturing properties should take it in order that they may add to their products electrical machinery and goods. Clock and watch makers should take it because the delicate instruments used for electrical measurements have created a demand for accurate and trained eyes and skilled hands which cannot be filled. One of the most important branches of electrical engineering is measurement, and the clock or watch maker who is ambitious to advance may qualify himself for employment in standardizing bureaus and in laboratories to make tests of electrical and magnetic apparatus and calibrate instruments, etc. Men who are qualified to do this work receive large pay and occupy responsible and influential positions.

OUR COURSE FOR THOSE WHO WISH TO LEARN TO INSTALL AND OPERATE ELECTRIC LIGHT POWER AND RAILWAY PLANTS.

Electrical Power and Lighting Course.

A course in the installation, care and operation of electric light, power and railway plants to meet the wants of busy men who desire to put into actual practice as early as possible the information they acquire, should give the student instruction in the subject of electricity proper just as soon as he has mastered the mathematics and physics necessary to a proper understanding of the subject. Such men do not require as much mathematics and physics as is given in our Mechanical-Electrical Course. The class of people who utilize electrical machinery is, of necessity, much greater than that which designs and manufactures, and the information required by them is of different character and scope. In the preparation of the Instruction Papers of our Electrical Power and Lighting Scholarship this has been kept in mind.

Plan.

Instruction Included in the Course.

This Scholarship includes complete instruction in arithmetic, mensuration and the use of letters in algebraic formulas and in mechanical drawing. The student learns enough of mathematics to compute the power and capacity of electrical machinery, and learns how to make a drawing of a machine or piece of machinery. The electrical instruction begins with elementary electricity and magnetism and the simple arithmetic of electrical quantities and extends through the construction, installation, operation and care of dynamos and motors of different kinds, including those for railway and mine use; the connection of switch boards for various purposes; the calculation of wiring for lighting and power circuits; the construction, efficiency and candle power of arc and incandescent lamps; the construction and management of electric railways, etc.

WHY INSTALLATION ENGINEERS NEED TO BE EDUCATED.

What He Must Know.

Among the principal classes of men employed in electrical industries are Installation Engineers, who superintend the equipment of central or isolated electric light or power plants, electric railways, mining plants, etc., and run the same when completed. In order to do this work properly the Installation Engineer should know a great deal more about his business than most of them really do. In regard to the general features of the plant, he must know how to choose the best apparatus for the work required, etc. He must be aware of the conditions which determine the location of the central station, such as the availability of water, nearness to coal supply and the center of distribution, etc. In laying out his plants he must determine such factors in economy of operation as whether belt driving or direct connection is best, if the use of storage batteries will add to the economy of operation, and be able to determine whether, for the work to be done, a continuous or alternating current system should be used. He must be able to calculate the weight of copper required to transmit a given horse power a given number of miles with a given loss.

Station Details.

In regard to the minor details of installation, he should know why electrical machinery must be located in a dry place and why it must be insulated from the foundations. He should know why switch-boards must be kept free from moisture and equipped with metallic or non-combustible frames, why the rheostats and other instruments must be in plain sight and so arranged as to provide ample room for inspection and ventilation, why lightning arrestors must be attached to each side of every overhead circuit connected with a station and how they should be connected with the earth. He should be able to determine the proper location of his pole line, and be familiar with the latest methods and best appliances used in its erection. He should understand the necessity of testing out circuits at regular intervals, and should know why telegraph, telephone and similar wires should not be placed on the same pole with electric light or power wires; why converters or transformers should not ordinarily be placed inside of any building except the central station, and why they should not be placed against the outside walls of that; why, in the case of electric railways, automatic circuit breakers should be provided and why the overhead wiring for trolley systems should be constructed in sections, so that the current may be cut off at will from one or more of the sections.

Outside Work.

His Responsibilities.

When called upon to install the lights in, for example, a large office building, he should be able to decide upon the best system of distribution to use, and having done this to properly lay out the centers of distribution and group the lamps. He must know the reason for making only a limited number of them dependent upon a single cut-out. He should be able to select the minor appliances which contribute to the successful operation of such a piece of work, and see that they are properly located and installed.

We Give Him the Instruction He Needs.

These are only a few of the things which the Installation Engineer should know, and without this knowledge he cannot perform his work as safely and economically as would otherwise be the case. In order to get this information he must study, and our Electrical Power and Lighting Scholarship is intended to give him the instruction he requires.

MEN IN CHARGE OF ELECTRIC PLANTS REQUIRE THEORETICAL KNOWLEDGE.

An Illustration of their Educational Requirements.

Men who manage plants after they are installed need to take this Course. In fact, without theoretical knowledge they are not qualified to perform the duties devolving upon them. A recent suggestion of the man running a small lighting plant to purchase a new iron-clad, compounded, alternating dynamo and run it in parallel with his old alternator (which was a surface wound, non compounded machine giving a current of a

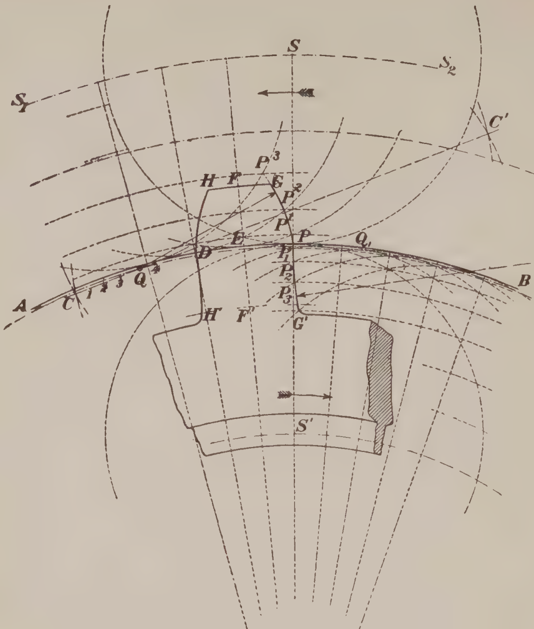


Fig.4.

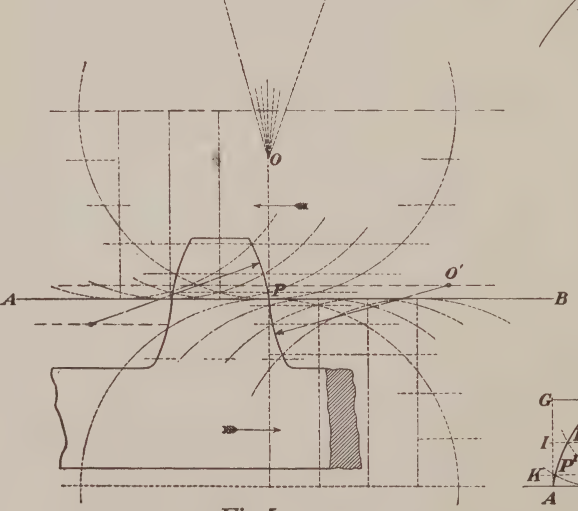


Fig.5.

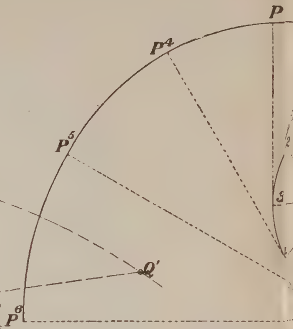
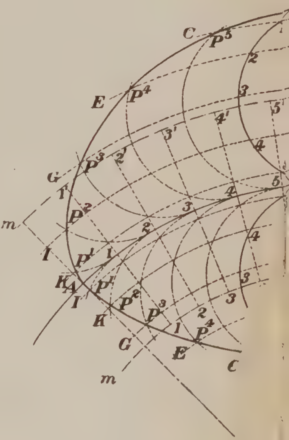
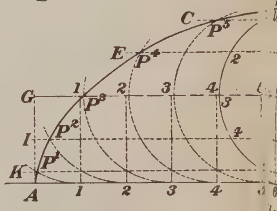


Fig.3.





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PROFILES OF GEAR TEETH.

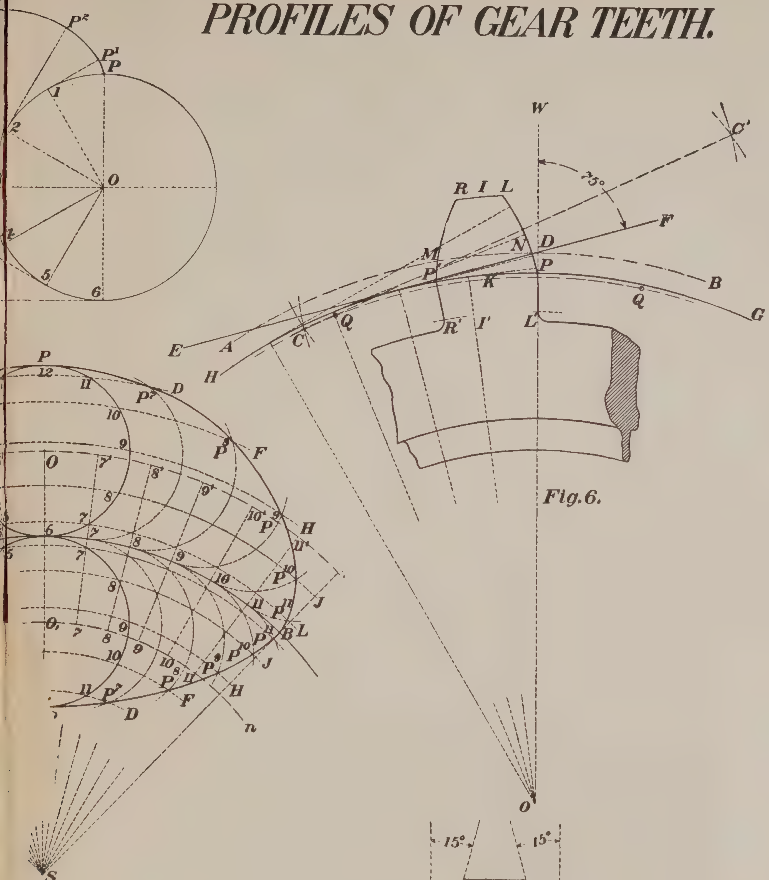

Fig.6.

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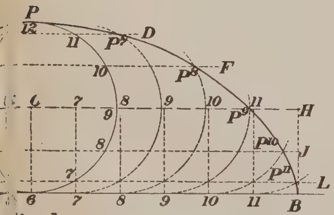

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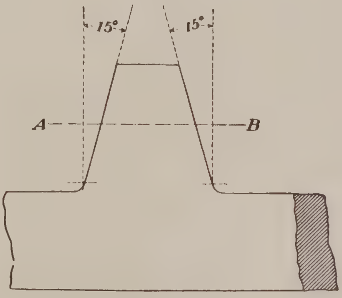

Fig.7.

JOHN SMITH, CLASS Nº4529.

liery Engineer Co.

r on Drawing of The Correspondence School of Electricity.
d.)

different frequency) shows how badly some men holding responsible positions in connection with electrical machinery need technical education. The man in charge of this plant, probably from practical experience knew that direct current machines could be connected in this manner, but being without a knowledge of the theory of alternators and induction apparatus he did not know that both machines would have been periodically short circuited by his proposed arrangement.

Those in Authority Should Study.

The electric street railways and power plants, and the larger electric light plants are beginning to see the necessity of employing competent persons to superintend their machinery. The old time superintendent who held over under the change from horse to electricity, and those in authority who have only a superficial knowledge of the business must go.

STEAM ENGINEERS MUST UNDERSTAND ELECTRICITY.

Increasing Use of Dynamos in Engine Rooms.

Stationary, marine and locomotive engineers and firemen should take our Electrical Power and Lighting Scholarship or one of our Steam Engineering Scholarships in order that they may qualify themselves to care for electrical machinery and apparatus. The number of engine rooms containing dynamos is great already and is rapidly increasing. There is no reason why the engineer should not learn to look after the dynamo as well as the engine. By so doing, he assumes greater responsibility and is entitled to more pay.

Engineers Required to Run Them.

The same forces which evolved the automatic engine of today out of the old slide valve engine of yesterday are at work in the evolution of a more efficient class of engineers. While electricity may soon come into general use for killing off criminals, it is already doing much toward killing off the "know-it-all" class of engineers, too indolent to study, by requiring a higher standard of theoretical education of men in charge of steam plants. The marine or stationary engineer who is not competent to run and care for electrical machinery will soon be a back number.

Steam Engineering Circular Sent Upon Request.

Each of our Steam Engineering Scholarships (Stationary, Marine and Locomotive) includes thorough instruction in the care and operation of dynamos and motors. Circular of Information of The Correspondence School of Steam Engineering will be sent free of charge to any address, upon application.

LINEMEN AND WIREMEN SHOULD QUALIFY TO FILL RESPONSIBLE POSITIONS.

Cannot Advance Without Study.

Without studying or reading, men engaged in wiring will never be promoted to positions of trust and responsibility. Their work offers few opportunities to become familiar with the principles of electricity. In order to advance, it is necessary to have knowledge, and in the case of wiremen and linemen, this knowledge must be gained outside of their regular occupations.

They must study at night or at times when they are not busy. Correspondence instruction is adapted to their requirements; they do not need to lose an hour's work, nor to leave their own firesides. The student can study at any time, so it matters not whether he works days or nights. His teacher is always at hand. He takes his own time to finish; we do not hurry him, no matter how long it may require, as our desire is that he may read to understand. When he gets through we wish him to testify that we have done him good, so that his endorsement of the advantages of the method may induce others to enroll.

Dangers of Ignorance.

But the desire for promotion is not the only incentive for wiremen and linemen to educate themselves. There is a moral obligation resting on every man engaged in wiring His own life, the lives of his fellow-workmen and others, depend upon the carefulness with which he does his work; and this carefulness is only assured when he has a knowledge of the dangers involved in a careless or ignorant act. Many disastrous fires, resulting in loss of life and property, have been caused by the ignorance and carelessness of a wireman. Nearly all fires caused by electricity are attributable to faulty wiring.

Fitted to Obtain Licenses.

In the interest of the protection of lives and property, several States have already enacted laws requiring wiremen and linemen to have licenses. While the examinations to obtain these licenses are comparatively easy, yet a great many otherwise competent men fail to pass them, because they cannot intelligently tell what they know. They may know how and why a thing is done, but they cannot *tell* how or why. One of the great advantages of the correspondence method is that it not only teaches the pupils what to say, but also, how to say it.

THE BEST WAY FOR DYNAMO TENDERS TO QUALIFY TO EARN MORE MONEY.

Should Understand the Principles of Electricity.

The dynamo tender, intimately associated with the source of the electric current, is well situated to obtain by observation and practical experience a knowledge of the application of the principles of electricity. Knowing the principles he can understand the manner in which they have been applied in the construction of the particular machine or machines on which he is in attendance.

Can Learn to Detect Troubles Before Breakdowns Occur.

His value, however, to his employers, and his opportunities for advancement, are brought out, not when the machinery is all running smoothly, but when it begins to give trouble. The time to repair anything is before the break-down occurs. The dynamo should be looked after as soon as irregularities begin to show themselves, and not after these have developed so as to necessitate extensive repairs. With a knowledge of the principles governing dynamo construction and operation such as is given in our Electrical Power and Lighting Course, the dynamo tender will be able to determine, for example, by the character of the sparking at the brushes whether an open or short circuit is developing in the armature winding or whether the unusual manifestations, if there are such, are simply due to the overloading of the machine, and similarly can detect other troubles.

The Best Investment.

Every dynamo tender has a natural desire to rise above his position, and self-education is the way, and the only way, in which he can rise. It is his duty, as it is the duty of every other man, to take advantage of every honorable opportunity for advancement. An education in the theory of his trade is the best investment he can make.

MOTORMEN ON ELECTRIC STREET CARS SHOULD STUDY THE NATURE OF THE CURRENT WHICH THEY CONTROL.

Education the Motorman's Safeguard.

Every motorman is responsible for the safety of his car, and for the lives of the people inside, crossing the tracks and occupying the streets. He must be quick to think and act. The exercise of good judgment on his part may prevent grave accidents. Good judgment in his case comes not only from experience, but also from a thorough knowledge of the force under his control. With such knowledge a motorman will be qualified to run his car safely, and in case of a breakdown or burnout, to locate the trouble and in many cases repair it.

The Opportunity We Offer.

The School affords the same opportunity to the motorman that it does to other electrical employes. He can learn the theory of Electricity and qualify himself to superintend an electrical railway. No pains have been spared in preparing the Instruction and Question Papers to make them clear. The examples are original and chosen to illustrate the application of the work to actual practice. Illustrations are freely used wherever they will make the text easier to be understood, and only the results of the most modern and successful practice are represented.

During the past year efforts have been made to procure legislation providing that no one who has not passed an examination as to his fitness shall be employed as a motorman. Such legislation will probably soon become general, and every motorman who wishes to retain his position as well as the motorman who desires to improve his condition and that of his family, will need to study.

WHAT OUR ELECTRICAL POWER AND LIGHTING SCHOLARSHIP OFFERS TO OTHER CLASSES.

Telegraphers, etc., Can Study Electricity to Advantage.

Telegraphing, electro-plating, electro-typing and other similar occupations are important branches of the great electrical industry, and any young man employed in them can, in his spare moments, acquire with us such instruction in the principles of electricity and the care and operation of electrical machinery as will qualify him for advancement.

Clerks and Bookkeepers May Take it.

Clerks and bookkeepers who are so situated that they can gain access to electrical machinery and apparatus, should take our Electrical Power and Lighting Scholarship in order that they may escape the drudgery of office work and engage in the pleasant and profitable occupations which the electrical industries provide, and many of which will give them the exercise in the open air which they so sorely need.

Brokers, etc., Can Acquire a Knowledge of the Subject.

Brokers and commission agents should take the Electrical Power and Lighting Scholarship in order that they may deal intelligently in the stocks of electrical concerns, and know how to report on them. Insurance agents and inspectors should take it to be able to examine properties, and decide whether the wiring has been done in a safe manner.

ADVICE TO INTENDING STUDENTS.

The Shorter and Less Expensive Electrical Courses are Recommended to All Classes of Electrical Workers Excepting Those Who Wish to Learn to Design Electrical Machinery.

To men who wish to qualify themselves to safely and economically operate and care for electrical machinery and appliances, some one of the three following Scholarships: the Electrical Railway Scholarship, the Electrical Lighting Scholarship, or the Electrical Power and Lighting Scholarship, will afford all the necessary education. Unless they wish to study the whole theory of electricity and learn to design electrical machinery, it is not necessary for them to take the higher-priced Scholarships, as they can thoroughly qualify themselves for their duties and acquire the accomplishment of making a neat mechanical drawing in one of the above-named courses.

Persons who educate themselves are compelled to study after working hours, and should not undertake unnecessary work, and, therefore, we advise those who merely wish to qualify themselves to operate and care for electrical machinery to take one of the shorter electrical courses in preference to the Mechanical-Electrical Course, which requires more study.

CAUTION.

Necessity for Instruction in Mathematics and Physics.

It is impossible to make satisfactory progress in the study of the installation and operation of electrical machinery without having first obtained a knowledge of arithmetic, mensuration, the use of letters in algebraic formulas and the principles of mechanics, and therefore such preliminary instruction is provided in our various electrical courses.

Nor can a person expect to educate himself to fill the duties required of an Electrical Engineer or to design electrical machinery, by the study of electrical subjects, without having first laid an educational foundation in arithmetic, algebra, geometry and trigonometry, physics, steam engines, boilers, strength of materials, and machine design, and therefore such an educational foundation is provided for in our Mechanical Electrical Course.

As well attempt to erect a permanent building without a foundation as to try to obtain an electrical education without the preliminary training outlined above, and which in our courses, although very thorough, is, because of the limited time at the disposal of our students for study, reduced as much as possible. Institutions, therefore, which advertise courses of study in electrical subjects which do not provide this preliminary training cannot avoid disappointing those who enroll with them.

SCHOLARSHIPS.

Course for Electrical Engineers and Artisans, Machinists, Draughtsmen, etc.

I.—THE MECHANICAL-ELECTRICAL SCHOLARSHIP.

Prices $50.00 in Advance, $55.00 on the $5.00 Installment Plan, $60.00 on the $2.00 Installment Plan.

SUBJECTS TAUGHT:

Arithmetic,
Algebra,
Logarithms,
Geometry and Trigonometry,
Elementary Mechanics,
Hydromechanics,
Pneumatics,
Heat,
Geometrical Drawing,
Mechanical Drawing,
Steam and Steam Engines,
Strength of Materials,
Applied Mechanics,
Steam Boilers,
Machine Design,
Principles of Electricity,
Electrical Measurements,
Batteries,
Applied Electricity,
Power Transmission,
Dynamo-Electric Machine Design.

When sold on the $5.00 installment plan, the first payment is $10.00 and the balance is payable at the rate of $5.00 per month.

When sold on the $2.00 installment plan, the first payment is $2.00 and the balance is payable at the rate of $2.00 per month.

Additional charge for postage to students residing in countries of the Universal Postal Union, outside of the United States, Canada and Mexico, $5.00, payable in advance.

Mechanical-Electrical Diploma.

Students who complete all the subjects of this Scholarship (which includes all the subjects taught in The Correspondence School of Mechanics and The Correspondence School of Electricity), and pass a final examination, are awarded the Mechanical-Electrical Diploma.

For a slight additional charge, students, as soon as they are enrolled, can obtain a complete duplicate set of Instruction Papers, Question Papers, Drawing Plates, and Keys of the course, all fully indexed and bound in half leather.

Special Arrangements for Mechanical and Other Engineers, etc.

Mechanical, Civil, Hydraulic, Railroad, Bridge, Sanitary, Architectural, Municipal and Mining Engineers and other persons enrolling in the Mechanical-Electrical Scholarship, who have the requisite knowledge of mathematics and the theory of mechanics to study electrical subjects advantageously, and who satisfy the management of the School by an examination that they are qualified to do so, will be permitted to omit all the subjects preceding Fundamental Principles of Electricity. In such cases, a reduction of $15 will be made in the price of the Scholarship.

Course for Dynamo Tenders, Linemen, Wiremen, Motormen, Steam Engineers, etc.

II.—THE ELECTRICAL POWER AND LIGHTING SCHOLARSHIP.

Prices $25.00 in Advance, $30.00 on the $5.00 Installment Plan, $34.00 on the $2.00 Installment Plan.

SUBJECTS TAUGHT:

Arithmetic,
Mensuration and the Use of Letters in Algebraic Formulas,
Mechanics,
Geometrical Drawing,
Mechanical Drawing,
Dynamos and Motors,
Electric Lighting,
Electric Railways.

When sold on the $5.00 installment plan, the first payment is $5.00 and the balance is payable at the rate of $5.00 per month.

When sold on the $2.00 installment plan, the first payment is $2.00 and the balance is payable at the rate of $2.00 per month.

Additional charge for postage to students residing in countries of the Universal Postal Union, outside of the United States, Canada and Mexico, $3.00, payable in advance.

Electrical Power and Lighting Diploma.

Students who complete all the subjects of this Course and pass a final examination are awarded the Electrical Power and Lighting Diploma.

For a slight additional charge, students, as soon as they are enrolled, can obtain a complete duplicate set of the Instruction Papers, Question Papers, Drawing Plates and Keys of the course, all fully indexed and bound in half leather.

Course for Those Employed About Electric Light Plants.

III.—THE ELECTRIC LIGHTING SCHOLARSHIP.

Prices $20.00 in Advance, $24.00 on the $5.00 Installment Plan, $28.00 on the $2.00 Installment Plan.

SUBJECTS TAUGHT:

Arithmetic,
Mensuration and the Use of Letters in Algebraic Formulas,
Mechanics,
Geometrical Drawing,
Mechanical Drawing,
Dynamos and Motors,
Electric Lighting.

When sold on the $5.00 installment plan, the first payment is $5.00 and the balance is payable at the rate of $5.00 per month.

When sold on the $2.00 installment plan, the first payment is $2.00 and the balance is payable at the rate of $2.00 per month.

Additional charge for postage to students residing in countries of the Universal Postal Union, outside of the United States, Canada and Mexico, $2.50, payable in advance.

Electric Lighting Certificate of Proficiency.

Students who complete all the subjects of this course and pass a final examination are awarded the Electric Lighting Certificate of Proficiency.

For a slight additional charge, students, as soon as they are enrolled, can obtain a complete duplicate set of the Instruction Papers, Question Papers, Drawing Plates and Keys of the course, all fully indexed and bound in half leather.

Course for Those Employed About Electric Railway Plants.

IV.—THE ELECTRIC RAILWAY SCHOLARSHIP.

Prices $20.00 in Advance, $24.00 on the $5.00 Installment Plan, $28.00 on the $2.00 Installment Plan.

SUBJECTS TAUGHT:

Arithmetic,
Mensuration and the Use of Letters in Algebraic Formulas,
Mechanics,
Geometrical Drawing,
Mechanical Drawing,
Dynamos and Motors,
Electric Railways.

When sold on the $5.00 installment plan, the first payment is $5.00 and the balance is payable at the rate of $5.00 per month.

When sold on the $2.00 installment plan, the first payment is $2.00 and the balance is payable at the rate of $2.00 per month.

Additional charge for postage to students residing in countries of the Universal Postal Union, outside of the United States, Canada and Mexico, $2.50, payable in advance.

Electric Railway Certificate of Proficiency.

Students who complete all the subjects of this course and pass a final examination are awarded the Electric Railway Certificate of Proficiency.

For a slight additional charge, students, as soon as they are enrolled, can obtain a complete duplicate set of the Instruction Papers, Question Papers, Drawing Plates and Keys of the course, all fully indexed and bound in half leather.

Course for Bell Hangers, etc.

V.—THE WIRING AND BELLWORK SCHOLARSHIP.

Price $10.00 in Advance, or $14.00 in Installments.

SUBJECTS TAUGHT:

Arithmetic,
Mensuration and the Use of Letters in Algebraic Formulas,
Electric Light Wiring and Bellwork.

When sold on installments, the first payment is $2.00 and the balance is payable at the rate of $2.00 per month.

Additional charge for postage to students residing in countries of the Universal Postal Union, outside of the United States, Canada and Mexico, $1.00, payable in advance.

Wiring and Bellwork Certificate of Proficiency.

Students who complete all the subjects of this course and pass a final examination are awarded the Wiring and Bellwork Certificate of Proficiency.

For a slight additional charge, students, as soon as they are enrolled, can obtain a complete duplicate set of the Instruction Papers, Question Papers, Drawing Plates and Keys of the course, all fully indexed and bound in half leather.

Keys to the Question Papers can be purchased at the rate of 50c. each, as explained on page 43.

Students have the option of taking Drawing in connection with their other studies.

Instruction Papers Not Sold Without Instruction.

Instruction and Question Papers and Drawing Plates are not sold or furnished to any except those receiving instruction in accordance with the plan of the School.

TIME REQUIRED TO COMPLETE THE COURSES.

Depends on Circumstances.

It is impossible to say how long it will take to finish a course, because the progress of students is influenced by conditions never exactly alike. The time required depends upon natural ability, previous education, habits of application and the time which can be devoted to study. It will take a student who can devote two hours a day for six days in the week from two to three years to finish the Mechanical-Electrical Scholarship, and from three months to a year to complete any of the other courses.

CATALOGUE OF STUDIES.

Subjects.	Subdivisions and Details of the Subject.
Arithmetic.	Notation—Numeration—Addition—Subtraction—Multiplication—Division : Long Division ; Short Division—Cancellation—Fractions : Reduction of Fractions ; Least Common Denominator ; Reduction of Fractions to Fractions Having a Common Denominator ; Addition, Subtraction, Multiplication and Division of Fractions—Decimals : Addition, Subtraction, Multiplication and Division of Decimals ; To Reduce a Common Fraction to a Decimal ; To Reduce a Decimal to a Common Fraction ; To Express a Decimal Fraction Approximately as a Fraction Having a Given Denominator—The Use of the Symbols of Aggregation—Percentage—Denominate or Compound Numbers : Reduction of Denominate Numbers ; Addition, Subtraction, Multiplication and Division of Denominate Numbers—Involution—Evolution ; Square, Cube, and Other Roots ; Short Method—Ratio—Proportion : Direct, Inverse, and Compound Proportion.
Algebra.	Analogy Between Algebra and Arithmetic—Notation—Algebraic Signs—Reading Algebraic Expressions—Positive and Negative Quantities—Addition—Subtraction—Symbols of Aggregation—Multiplication : Multiplication of Monomials, Polynomials and Special Rules for Binomials—Division—Factoring—Least Common Multiple—Fractions : Reduction of Fractions—Addition, Subtraction, Multiplication and Division of Fractions ; Mixed Quantities and Complex Fractions—Involution—Evolution—Exponents—Radicals : Addition, Subtraction, Multiplication and Division of Radicals—Equations—Solutions of Equations of the First Degree—Solutions of Simple Equations Containing Radicals—Problems Leading to Simple Equations with One Unknown Quantity—Quadratic Equations: Pure and Affected Quadratic Equations ; Equations in the Quadratic Form ; Problems Leading to Quadratic Equations—Equations Leading to Two Unknown Quantities : Various Methods of Elimination ; Quadratic Equations Containing Two Unknown Quantities ; Problems Leading to Equations with Two Unknown Quantities.
Logarithms.	General Remarks on Logarithms—The Common or Abridged System of Logarithms—Characteristic and Mantissa—Rules for Determining the Characteristic of the Logarithm of Any Number—The Logarithmic Table—Rules and Explanations for Taking Out the Logarithm of Any Number—Rules and Explanations for Finding the Number Corresponding to a Given Logarithm—Application of Logarithms to Multiplication, Division, Involution and Evolution.

Geometry and Trigonometry.	Lines and Angles: Definitions and Properties of Plane Figures—Polygons: Regular, Equilateral and Equiangular Polygons; Quadrilaterals, Pentagon, Hexagon, Heptagon, Octagon, Decagon, Dodecagon—Triangles: Isosceles, Scalene, Right-Angled and Oblique-Angled Triangles—Properties of Triangles—The Circle: Diameter, Radius, Chord, Segment, Sector, Quadrant, etc.—Inscribed Angles—Inscribed Polygons—Passing a Circle Through Three Given Points—The Tangent and Tangent Circles—Concentric Circles—Trigonometry—The Six Parts of a Triangle—The Trigonometric Measure of an Angle—Trigonometric Functions: Sine, Tangent, Cosine, Cotangent—Application of Trigonometric Functions to Plane Triangles—Trigonometric Tables—Direction for Finding the Functions From the Tables—The Solutions of Triangles: The Solution of Right-Angled Triangles and of Oblique Triangles—Mensuration—Mensuration of Plane Surfaces: Rules for Finding the Area of Triangles, Quadrilaterals and Irregular Polygons—The Circle: Rules for Finding the Periphery and Length of an Arc of a Circle; Rules for Finding the Area of a Circle, of a Sector and of a Segment—Rules for Finding the Area and Periphery of an Ellipse—Finding the Area of Any Plane Figure—Mensuration of Solids—Rules for Finding the Area of the Convex Surface, Interior Surface and Volume of a Prism, Cylinder, Pyramid, Cone, Frustum of a Pyramid or Cone, Sphere and Cylindrical Ring—Projections—Symmetrical and Similar Figures.
Elementary Mechanics.	The Properties of Matter—Motion and Rest—Velocity—Force—The Three Laws of Motion—The Representation of Forces by Lines—Composition of Forces: Parallelogram, Triangle and Polygon of Forces; The Resultant and Equilibrant—Resolution of Forces—Dynamics—Gravitation: Laws of Gravitation and Laws of Weight—Falling Bodies: Acceleration and Retardation; Formulas for Falling Bodies—Projectives—Centrifugal Force—Statics—Moments—Couplets—Center of Gravity: Plane Area and Solid—The Three States of Equilibrium—Simple Machines: Lever, Simple and Compound; The Wheel and Axle and Wheelwork; The Pulley, Fixed and Movable Pulleys, Combination of Pulleys, Differential Pulleys; Inclined Plane; The Screw—Velocity Ratio—Friction: Coefficient of Friction; Law of Friction—Efficiency—Work—Energy: Kinetic and Potential Energy—Power—Horsepower—Force of a Blow—Density and Specific Gravity—Table of Specific Gravity of Various Substances.
Hydromechanics.	Hydrostatics—Pascal's Law—The Pressure Exerted by a Liquid in Various Directions: Downward, Upward and Lateral Pressure—Pressure Upon Oblique Surfaces—Buoyant Effects of Water—Principle of Archimedes—The Mean Velocity of Discharge—Velocity of Efflux—The Head and Equivalent Head—The Contracted Vein—Coefficient of Efflux—Coefficient of Discharge—Weirs—Calculating the Flow Through Weirs—The Flow of Water in

Pipes—Mean Velocity of Flow—The Actual Head—The Quantity Discharged From Pipes—The Calculation of the Diameter of a Pipe—Bends and Elbows.

Pneumatics.

Properties of Air and Gases—Tension—Torricelli's Experiment—Vacuum: The Mercurial and Aneroid Barometers—Mariotte's Law—Manometers and Gauges—Gauge Pressures and Absolute Pressures—Gay-Lussac's Law—Rules and Formulas for Calculating Volumes, Pressures and Temperatures of Air—Mixtures of Gases: Equal Volumes and Unequal Pressures; Unequal Volumes and Pressures; Unequal Volumes, Pressures and Temperatures—Pneumatic Machines—The Air Pump—Magdeburg Hemispheres—The Weight Lifter—The Baroscope—Air Compressors—Hero's Fountain—The Siphon, Its Principle and Action—The Calculation of the Power Necessary to Work a Pump.

Heat.

The Properties, Sources and Measurement of Heat—Nature of Heat—Thermometers: Fahrenheit, Centigrade and Reaumur Thermometers—Temperatures: Absolute Temperatures; Absolute Zero—Expansion of Bodies: Linear, Surface and Cubical Expansion; Coefficient of Expansion; Tables of Coefficients of Expansion of Various Substances—Heat Propagation: Conduction, Convection and Radiation—Law of Radiation of Heat—Dynamical Theory of Heat—Heat Units: British Thermal Unit, Thermal Unit and Calorie—Specific Heat—Tables of Specific Heat of Various Substances—The Calculation of Specific Heat—Latent Heat: Latent Heat of Fusion and of Evaporization; Table of Latent Heat of Different Substances—Sources of Heat and Cold: Physical, Chemical and Mechanical Sources—Mechanical Equivalent of Heat—First Law of Thermodynamics—Inner Work and Outer Work—Isothermal Expansion—Construction of the Isothermal Expansion Curve—Work Done During Isothermal Expansion—Adiabatic Expansion—The Adiabatic Expansion Curve—Work Done During Adiabatic Expansion—Second Law of Thermodynamics—The Ideal Heat Engine—The Reversible Cycle Process—Closed and Open Cycle—The Efficiency of a Perfect Heat Engine.

Geometrical and Mechanical Drawing.

Instruments and Materials: The Drawing Board; Paper; T Squares; Triangles; Compasses; Spacing Dividers; Pencils; Right Line, or Ruling, Pen; Irregular Curves; Protractors—Directions for Use and Care of Instruments—Inking—Drawing Ink—Sharpening Ruling Pens—Directions for Lettering—Simple Geometrical Constructions—Representation of Objects—Descriptions of Different Kinds of Lines Used on Drawings—Different Views of an Object—Drawing Various Views of Simple Objects in Orthographic Projection—Directions for Dimensioning Drawings—The Conic Sections: Ellipse; Parabola; Hyperbola—Intersections and Developments of Cylindrical and Conical Surfaces—Shade Lines, Their Use and Application—Conventional Method of Representing Screw

Geometrical and Mechanical Drawing, Continued.	—Drawing a Hand Wheel—Drawing a Crank—Section Lining—Scales—Constructing a Scale—Drawing Machine Details—Drawing a Band Wheel—Conventional Method of Representing Nuts—Drawing an Eccentric—Drawing a Brake Lever—Drawing a Connecting Rod—Drawing an Expansion Joint—Drawing a Reversing Lever—Drawing a 5-Inch Globe Valve—Drawing a Shaft Hanger—Drawing a Bench Vise—Gear Teeth : Tooth Profiles ; Generating Circle ; Describing Circle ; The Epicycloid ; The Hypocycloid ; The Involute—Pitch of Teeth—Spur Gears, Bevel Gears, Miter Gears and Racks—Drawing a Spur Gear and Pinion—Drawing a Bevel Gear and Pinion—Drawing a Weighted Governor—Drawing a Front and Side Elevation of a Battery of Three Boilers—Tracing : Tracing Paper and Tracing Cloth—Blue Prints—Directions for Making Blue Print Solutions and Taking Blue Prints—Drawing a Six Horsepower Horizontal Steam Engine.
Steam and Steam Engines.	Steam—Saturated and Superheated Steam—Outer Work and Inner Work—Steam Tables—Calculations Requiring the Use of Steam Tables—Expansion of Steam—Work Done by Expansion of Steam—Work Diagram—Steam Engine Mechanism—Plain Slide Valve Engine—The **D** Slide Valve and Steam Distribution—Rocker Arms—Indicators and Indicator Diagram—Directions for Taking Indicator Diagrams—Determination of Horsepower—Mechanical and Thermal Efficiency of the Steam Engine—Reading Indicator Diagrams—The Wheelock Engine—The Corliss Engine—Governors : Throttling Governors ; Pendulum Governors ; Shaft Governors—Compound Engine : Tandem, Cross, and Twin Compound Engines—Compound Engine Diagram—Combining the Diagram of Compound and Triple Expansion Engines—Ratio of Cylinders—Horsepower of Compound Engines—Balanced Valves—Multiple Expansion Engines—Mechanics of the Steam Engine—Condensers : Surface Condensers and Jet Condensers—Calculation of Water Required by Condensers—Calculation of Cooling Surface of Condensers—The Fly-wheel—The Calculation of the Weight of a Fly-wheel—Stephenson Link Motion.
Strength of Materials.	Material Used for Construction : Cast Iron ; Wrought Iron ; Steel ; Timber—Stresses and Strains—Tension—Experimental Laws—Coefficient of Elasticity ; Elastic Limit ; Ultimate Strength ; Ultimate Elongation ; Compression —Shear—Factors of Safety : Tables of Factors of Safety —Strength of Pipes and Cylinders—Force Diagram—Equilibrium Polygon—Composition of Moments—Graphical Expression for Moments—Beams : Simple and Cantilever—Reactions of Supports—The Vertical Shear—Application of Force and Equilibrium Polygon to the Calculation of Reaction of Supports, Shearing Stress and Bending Moment of Beams—The Neutral Axis—The Moment of Inertia and Radius of Gyration—The Calculation of Sizes of Beams for Strength—Deflection of Beams—Comparison of Strength and Stiffness of Beams—Columns—Calculation

of Sizes of Columns—Torsion—Calculation of Sizes of Shafts—Ropes—Chains.

Applied Mechanics.

General Remarks—Link Mechanism—Reversing and Non-Reversing Levers—Bell-Crank Levers—Crank and Connecting Rod Mechanism—Crank and Slotted Cross-Head Mechanism — Slow Motion Mechanism — Toggle-Joint Mechanism—The Forces Acting in Link Mechanism—Quick Return Motion : Vibrating Link Motion and Whitworth Quick Return Motion—Other Linkages : Universal Joint ; Double Universal Joint ; Watt's Parallel Motion—Cams : Plate Cam ; Harmonic Motion Cam ; Positive Motion Cam—Belting—Power Transmission by Belt : The Effective Pull ; Determination of Width ; Determination of Horsepower That a Belt Will Transmit ; Double Belt—Speed Cones—Open and Closed Belts—Stepped Pulleys—Care and Use of Belting—Guiding Belts—Belt Fastening—Connecting Non-Parallel Shafts by Belt—Guide Pulleys—Wheels in Trains : Direction of Rotation ; Idle Wheels ; The Knee Joint—Engine Lathe Train—Back Gears—Screw Cutting—Reversing Mechanism : Mangled Gears ; Clutch Gearing ; Shifting Belt Mechanism—Differential Gearing : The Two-Wheeled Train ; The Sun and Planet Motion ; Higher Wheel or Epicyclic Trains ; Differential Bevel Train ; Differential Back Gears—Gear Wheels—Circular and Diametral Pitch—Sizing Gear Blanks—Law of Tooth Contact—The Epicycloidal System—The Involute System — Racks — Bevel Gears — Worm Gears — Ratchet Wheels—Dynamometers : Prony Brakes ; Rope Brake—Transmission Dynamometers—Valve Gears—Valve Gear Diagrams—Application of Valve Diagrams to Plain Slide Valve—Problems Requiring the Use of Valve Diagrams—Setting the Slide Valve — Shifting Eccentrics — Double Valve Gears—The Meyer Valve—The Corliss Valve Gear—The Stephenson Link Motion—Designing the Link Motion: The Suspension of the Link ; Proportions of the Link—The Weighted Governor—Different Kinds of Shaft Governors.

Steam Boilers.

Description of Various Types of Steam Boilers : The Plain Cylindrical Boiler ; The Flue Boilers ; The Return Tubular Boiler ; The Cornish and Lancashire Boiler ; The Galloway Boiler ; The Locomotive Boiler ; Vertical Boilers ; Babcock and Wilcox Water Tube Boiler ; The Root Water Tube Boiler ; The Heine Water Tube Boiler ; The Stirling Boiler ; The Harrison Safety Boiler ; The Hazleton Boiler ; The Scotch Marine Boiler ; The Double-Ended Scotch Boiler—Boiler Materials—Strength of Boiler Shells and Flues—Riveting and Riveted Joints : Lap and Butt Joints ; Single Riveted and Double Riveted Joints ; Strength of Joints—Arrangement of Joints and Plates—Calking—Flat Surfaces—Boiler Stays—Crown Bars—Strength of Stayed Surfaces—Boiler Fittings : Feed Apparatus ; Globe Valves and Check Valves ; Feed Water Heaters ; Economizers ; Safety Valve ; Calculations Pertaining to Safety Valves ; The Spring Safety Valve ; The Steam Gauge ; Gauge Cocks and Gauge Glasses ; Fusible

Steam Boilers, Continued.

Plugs ; Blow-Out Apparatus ; The Dome ; The Dry Pipe ; Manholes ; Mudholes and Handholes—Combustion and Fuels—Temperature of Combustion—Calculation of Air Required for Combustion—Natural and Forced Draft—Water Circulation—Losses of Heat—Furnace Fittings : Grates ; The Argand Steam Blower ; Bridge ; Mechanical Stokers—Firing—Chimneys—Calculations Pertaining to Chimneys—Proportions of Boilers : Grate Surface ; Heating Surface—Horsepower of Boilers—Boiler Trials—Directions for Making Boiler Trials—Determining the Quality of the Steam—The Separator Calorimeter—Incrustation—Wear and Tear of Boilers—Inspection and Testing—Boiler Explosions—Management and Care of Boilers—Boiler Setting—Boiler and Pipe Covering—Steam Pipes—The Separator—The Steam Loop—The Injector.

Machine Design.

Introductory—General Procedure in Designing Machinery—Materials Used in Machine Construction : Cast Iron, Contraction of Cast Iron, Chilled Castings ; Wrought Iron and Steel ; Copper ; Bronze or Gun-Metal ; Phosphor-Bronze ; Manganese Bronze ; Brass ; Wood—Fastenings : Screws, Bolts and Nuts ; Forms of Screw Threads, The **V** Thread, The Square Thread, The Trapezoidal Screw Thread, Multiple Threaded Screws, Gas Pipe Threads—Strength of Screw Bolts—Proportions of Bolts and Nuts—Wrenches—Forms of Bolt Heads : The Hook Bolt Head, Countersunk Head and **T** Head ; Foundation Bolts—Forms of Nuts—Locking Nuts : Jamb Nuts, Set Screws, Stop Plates, Grover's Spring Washer and Other Locking Devices—Forms of Bolts and Screws : Stud Bolts ; Tap Bolts ; Patch Bolts ; Bolts in Shear ; Knuckle Joint—Keys : Forms of Keys ; The Sunk Key ; Sliding or Feather Keys ; Round or Pin Keys ; Strength and Proportions of Keys—Cotters : Strength and Proportions of Cotters ; Taper of Cotters ; Locking Arrangements for Cotters ; Split Pin Cotters—Rotating Pieces : Journals ; End Journals, Size and Proportions of End Journals, Bearing Surface or Projected Area : Neck Journals ; Friction of Journals ; Pivots and Collar Journals—Shafts : Line Shafting ; Speed of Line Shafting ; Distance Between Bearings ; Shafts Subjected to Bending ; Shafts Subjected to Combined Bending and Twisting ; Hollow Shafts—Shaft Couplings ; Box or Muff Couplings ; Clamp Couplings ; Flange Couplings ; Solid Flange Couplings ; Universal Joints or Flexible Couplings ; Loose Couplings ; Friction Couplings or Clutches ; Shifting Gear for Clutches—Bearings : Solid Journal Bearings ; Divided Bearings ; Seats or Steps, Lining for Seats—Pedestals : Crank Shaft Pedestals ; Ball and Socket Bearings—Wall Brackets and Hangers : Pivot or Footstep Bearings ; Pivots with Loose Disks—Tooth Gearing : Spur and Bevel Gears ; Materials of Gearing ; Strength of Gear Teeth ; Wear of Teeth ; Shrouded Gear Teeth : Proportions of Spur and Bevel Gear Wheels ; Rims ; Arms of Wheels ; Hubs or Naves of Wheels ; Built-up Wheels ; Proportions of Bevel Gears—Worm Gearing : Construction of Worm Gearing ; Friction of Worm Gear-

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ing—Friction Gearing—Flexible Gearing: Belt Gearing; Belt Materials; Belt Pulleys; Solid and Split Pulleys, Rims of Pulleys, Flange Pulleys, Arms of Pulleys, Hubs of Pulleys, Loose Pulleys, Wrought-Iron Pulleys, Maximum Speed of Cast-Iron Pulleys, Examples of Belt Pulleys, Counterbalance; Rope Belting; Ropes, Power Transmitted by Ropes, Pulleys for Rope Gearing, Guide Pulleys, Idlers and Tension Pulleys: Wire Rope Gearing; Tensions in a Suspended Rope; Stresses in a Wire Rope; Ratio of Tensions; Wire Rope Pulleys; Power Transmitted by Wire Ropes: Chains; Strength of Chains; Chain Drums; Flat Link Chains; Hooks—Pipe Flanges: Gaskets—Steam Engine Design: Preliminary Data; Boiler Pressure; Piston Speed; Point of Cut-off; Clearance; Back Pressure—Cylinders and Steam Chests: Steam Ports and Passages—Crank Shafts: Crank Pins—The Piston: The Hollow Piston; The Built-up Piston; The Solid Piston; Piston Packing—Piston Rods: Approximate Formulas for Piston Rods: Connection of Rod to Piston—Connecting Rods: Strap Ends; Marine Ends—Cross-Heads—Valves, Valve Stems and Eccentric Rods—Eccentric Sheaves and Straps—Stuffing Boxes—Engine Fly-wheels: Construction of Fly-wheels—Engine Frames or Beds—Examples of Engine Proportions.

Fundamental Principles of Electricity.

Nature of Electricity—Electrostatics: Production of Static Electricity; Properties of Charges; Positive and Negative Charges; Electric Series—Electrostatic Instruments: Electroscope; Torsion Balance—Conductors and Insulators—Electrostatic Induction: Free and Bound Charges; Inductive Capacity; Electrophorus—Electrostatic Machines: Friction and Induction Machines—Condenser; Leyden Jar—Electrodynamics: Potential and Current—Voltaic Cell: Electrolyte; Voltaic Elements—Chemical Actions in a Simple Cell; Electromotive Series—Distinction between Electric Currents and Static Charges—Thermo-Electric Currents—Circuits: Open and Closed Circuits; External and Internal Circuits; Divided Circuits; Series and Parallel Connection—Methods of Connecting Cells in Series, Parallel or Parallel Series—Electrical Units: Ohm, Ampere and Volt; Ohm's Law—Relation between Resistance, and Length and Area of Conductors; Rules, Formulas and Examples for Finding the Resistance of Conductors of Different Lengths and Areas—Comparison of the Resistances of Different Substances—Rate of Flow of Currents; Methods of Measuring Currents; Electro-Magnetic and Electro-Chemical Effects—Applications of Ohm's Law to Closed Circuits: Methods of Determining Any One of the Factors, Electromotive Force, Current, or Resistance, of a Circuit, the Other Two Being Known; Examples—Fall of Potential, or Drop: Hydraulic Analogy; Examples in Finding the Resistance of Conductors Required to Transmit a Given Current with a Given Drop; Examples in Finding the Internal Drop in Batteries or Other Sources of Electricity—Total and Available Electromotive Force: Strength of Current; The Coulomb—Elec-

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trical Work : The Joule ; Equivalent of the Joule—The Watt : Finding the Energy Expended in Circuits ; Examples—Applications of Ohm's Law to Derived Circuits—Rules and Formulas for Finding the Joint Resistance of Two or More Branches of a Circuit ; Examples—C. G. S. System of Units : Fundamental and Secondary Units ; Absolute and Practical Electrical Units—Magnetism : Types of Magnets ; Poles ; Neutral Line ; Axis of Magnetism ; Compass ; Laws of Magnetic Attraction and Repulsion—Magnetic Lines of Force : Direction of Lines of Force—Magnetic Circuits; Simple, Compound, and Closed Magnetic Circuits—Magnetic Induction : Magnetic Density, Magnetic Units—Electro-Magnetism, Reaction of Currents and Magnets—Lines of Force Surrounding a Conductor ; Relation between the Direction of the Current and the Direction of the Resulting Lines of Force—The Solenoid : Magnetizing Force and Magnetic Density ; Ampere Turns ; Magnetic Permeability—Electro-Magnets : Various Forms—Magneto-Motive Force : Relations between Magnetizing Force and Number of Lines of Force ; Tables and Curves Showing the Magnetic Characteristics of Various Grades of Iron and Steel ; Methods of Plotting the Curves—Magnetic Reluctance ; Methods of Calculating Magnetic Circuits — Residual Magnetism ; Hysteresis ; Tables and Curves Showing Hysteresis Loss in Soft Iron ; Magnetic Leakage—Lifting Magnets : Rules and Formulas for their Design—Magnets for Attraction : Short and Long Ranged Magnets—Electro-Magnetic Induction : Laws of Induction ; Determination of E. M. F.; Production of Induced E. M. F.; Electro-Magnetic, Self-Induction, and Mutual Induction ; Induction Coils—Description of Experimental Apparatus Furnished : The Leclanche Cell ; Compass ; Magnet-Bar and Horseshoe ; Wire ; Design for Switch ; Directions for Their Use—Experiments With the Same to be Performed by the Student.

Electrical Measurements.

Principal Manifestations of an Electric Current : Heating ; Electro-Chemical and Electro-Magnetic—Theory of the Galvanometer — Absolute Measurement of Current Strength ; Tangent Galvanometer—Table of Values of the Earth's Magnetism—Controlling Magnets ; Examples Showing the Application of the Formulas Concerning Tangent Galvanometers—The Sine Galvanometer—Reflecting Galvanometer—D'Arsonval Galvanometer—Ballistic Galvanometer ; Its Use in Obtaining the Magnetic Characteristics of Iron—Galvanometer Shunts—Precision in Measurements : Errors to be Avoided ; Limits of Accuracy ; Significant Figures — Electro-Chemical Measurements : Decomposition of Liquids ; Weight Method ; Volume Method ; Apparatus Required ; Examples—Measurements of Difference of Potential : Ammeters and Voltmeters ; Zero Method—Measurements of Resistance ; Fall of Potential Method ; Comparison of Known and Unknown Resistances ; Wheatstone Bridge ; Different Arrangements ; Examples—Slide Wire Bridge—Specific Resistance : Tables Giving the Specific Resistance of Various Substances,

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and Size of Accumulators for Lighting Plants—Setting Up the Cells; Preparing the Electrolyte; Charging; Care of Accumulator Plant—Cost.

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Theory of the Dynamo—Generation of E. M. F. under Various Conditions—Relation Between the Current in the Conductor, the Force to Move the Conductor, and the E. M. F. Generated: Electrical and Mechanical Efficiencies—Relation Between Dynamos and Motors—Graphical Representation of E. M. F. and Current: Motion in a Straight Line; In a Circular Path; Uniform Field; Bipolar Field—Sine Curve—Armature Cores—Commercial Currents: Direct and Alternating Currents; Continuous and Pulsating Currents—Alternators—Cycle; Period: Frequency; Phase; Phase Difference; The Addition of Two or More Alternating E. M. F.'s that Differ in Phase; Clock Diagram—Properties of the Alternating Current; Self-Induction; E. M. F. Induced in the Conductor; Lag of the Current; Phase of the Various E. M. F.'s of the Circuit; Material of the Magnetic Circuit and Shape of the Resulting E. M. F. Curve—Energy Expended in an Alternating Current Circuit: Effect of the Angle of Lag—Positive and Negative Work; Methods of Obtaining the Amount of Energy Expended; Effective Values of the E. M. F. and Current; Power Factor—Methods of Adding the Effective Values of E. M. F. and Current; Impedance—Inductance; The Henry; Reactance; Examples—Difference in Lag of the Current in Different Parts of the Circuit; Method of Adding the Differences of Potential—Three-Voltmeter Method of Measuring the Energy Consumed in an Alternating Current Circuit—Transformers: Ratio of Primary and Secondary E. M. F.'s; Phase Difference between Primary and Secondary E. M. F.; Effect of the Iron Magnetic Circuit—Relation between Primary and Secondary Current: Value of the Magnetizing Current—Step-up and Step-down Transformers—Principle of Armature Windings: Unipolar and Bipolar Induction: Brushes, Collectors and Commutators; Ring and Drum Winding; Disk and Cylinder Armatures—Bipolar Alternators: Neutral Space; Opposing E. M. F.'s in the Winding—Relation Between the Pitch, Width of Field, and Width of Coil in Both Ring and Drum Windings—The Addition of the E. M. F.'s of the Separate Conductors of the Coil—Right and Left-Handed Windings; Connection of Coils in Parallel or Series—Multipolar Alternators: Ring and Drum Windings for Armatures—Disk Armatures—Multiphase Alternators: Three-Phase Windings; Star and Delta Winding; Two-Phase Windings; Monocyclic Winding—Method of Obtaining Three-Phase Currents in the Secondary Direct Current Armature Windings; Unipolar Induction—Bipolar Induction: Open Coil Armatures; Windings in Series; In Parallel; Methods of Disconnecting Coils; Self-Induction of the Coils; Open Coil Armatures: Brush; Thomson-Houston Open Coil Multipolar Armatures; Westinghouse Open Coil Armature—Closed Coil Bipolar Armatures: Bipolar Drum Windings; Develop-

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ment from Open Coil Winding, both Ring and Drum; Value of the E. M. F.'s Generated—Effect of Current in the Armature Winding: Reversing the Current in the Short-Circuited Coils—Effect of the Inductance of the Coils; Sparking; Lead of the Brushes; Effect of the Contact Resistance—Reactions Between Conductors and the Magnetic Field: Cross and Back Ampere Turns of the Armature Winding; Shifting of Neutral Point; Effect on the Lead of the Brushes—Counter Torque of the Armature—Power Required to Turn the Armature—Closed Coil Ring Armature Windings: In Bipolar Fields; In Multipolar Fields; Cross-Connecting—Two Circuit Windings with the Same Number of Segments as Coils; With Twice the Number of Segments as Coils; Advantages and Disadvantages of the Various Forms—Closed Coil Drum Windings; Methods of Connecting Coils; Right and Left Hand; Wave and Loop Windings—Pitch—Crossing the Shaft—Eickemeyer Winding; Spiral Winding—End Connectors; Connections to the Commutator—Multipolar Drum Armatures: Wave and Loop Winding; Pitch; Advance; Bar Winding—Toothed Armatures—Motors; Principle of Operation; Torque; Counter E. M. F.—Direct Current Motors—Alternating Current Motors—Synchronous and Induction Motors; Two and Three-Phase Motors—The Telegraph: The Circuit—Telegraphic Instruments: The Key; The Sounder; The Relay—The Local Circuit—Lightning Arresters: Plate; Bradley's—Switches and Connections—The Earth Return—Repeaters: Wood's Button; Edison's Button; Milliken's Automatic; Bunnell's Automatic—Multiple Telegraphy: Differential Duplex System; Bridge Duplex; Differential Quadruplex—Description of the Plant of the Postal Telegraph Company at New York City—Relays on the Line and their Adjustment—Telegraph Lines, Poles and Insulation—Testing of Aerial Telegraph Lines: The Differential Galvanometer; Resistance; Earth Currents—The Loop Test; The Three-Wire Method—Insulation Resistance of a Telegraph Line: Faults and Crosses—Underground Wires; Submarine Cables; Testing by Weston's Instruments; Examples for Practice—The Telephone: Reception and Reproduction of Sound—Bell's Telephone; Blake's Transmitter—Safety Devices—Call-bells and Instruments—The Long Distance Telephone: Hunning Transmitter and Other Transmitters; Connections—Exchange Connections—Electric Incandescent and Arc Lamps—Construction and Mechanism of Each—Illumination: Candle Power of Electric Lights; The Mean Spherical Candle Power; The Efficiency of Electric Lights—Calculation of the Number of Lights Required to Light a Room; The Indicated Horsepower Required for Lighting—Electro-Metallurgy: Reduction of Metals; Electroplating; Electrotyping—Electric Welding: Thompson's Welder; Power Required—Welding of Street Car Rails.

Output of Armatures—Constant Current and Constant Potential Machines—Limits of Load; Heating; Cause of Heat-

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ing—Distribution of Armature Losses: Core Loss; Hysteresis and Eddy Currents; Friction; Wire Loss; Heat Radiated from Armature Surface—Permissible Rise in Temperature—Sparking: Sparking Limit of Load—Proportions of Armatures for Different Types of Windings; Rules and Formulas for Determining the Sizes of Armatures for Different Outputs and Speeds; Examples—Selection of Type of Armature and Winding; Calculations of Armature Windings; Number of Lines of Force; Number of Conductors—Best Densities in Armature Core and Air Gap—Slotted Armatures: Density in Teeth; Space for Winding; Insulation; Table of Sizes of Wires and Thickness of Insulation—Bar Windings; Attaching Commutator Leads—Magnetic Circuit: Materials; Best Densities in Various Parts; Economy in Design; Leakage; Consequent and Salient Poles; Examples of Magnetic Circuits—Calculations for Spool Windings: Empirical Formulas; Heating of Spools; Influence of Shape of Spool—Examples—Series, Shunt and Compound Winding; Additional Magnetizing Force Required for Compounding; Sayer's Winding; Thompson-Ryan Winding—Mechanical Construction — Armatures: Armature Cores; Punching; Slotting; Ventilating Spaces—Spiders: Material; Fastening to Core; To Shaft; Sizes of Spider Arms; Provisions for Bolts—Shafts: Material; Size; Diameter and Length of Journals; Stepped Shafts; Keys and Keyways—Commutators: Form; Relation of Diameter and Length; Materials; Insulation; Assembling; Fastening; Attaching Leads; Provision for Wear—Frame: Materials for Frame; Joints in the Magnetic Circuits; In the Frame; Removable and Solid Polepieces; Pole Shoes; Laminated Polepieces—Base—Standards: Coring—Frames for Motors for Special Applications—Bearings: Proportions of Bearings; Materials; Provisions for Lubrication; Self-Oiling Devices; Self-Aligning Bearings; Brushes; Materials Used; Contact Surface Necessary; Heating of Brushes—Brush Holders: Requirements; Practical Hints Concerning Brush Holders—Connections for Different Types of Machines; Connection Boards—Cables; Cable Tips—Auxiliary Apparatus: Field Regulating Rheostats—Motor Starting and Regulating Rheostats—Tests to Determine the Efficiency, Losses and Characteristics of Dynamo-Electric Machinery.

Power Transmission.

The Construction of Telegraph, Telephone, Electric Light and Electric Power Lines—The Resistance and Weight of Wire: Explanation of the Laws of the Brown and Sharpe Wire Gauge; Wiring Tables—Wire Resistances at Different Temperatures; Examples for Practice—The Percentage Conductivity of a Wire—Telegraph Lines: Sags and Stresses; Erection; Changes of Temperature; Stringing Several Wires at Once—Telephone Lines: Cables; Cross-talk; Electrostatic Capacity—Poles: Design; Erection; Corner Poles; Anchor Wires; Sizes of Poles, Cross-Arms and Braces; Roof Structures—Incandescent Light Lines: Wiring Symbols; Cut-Outs; Switches — Incandescent

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Lamp Circuits: Multiple Arc System; Multiple Series System; Three-Wire System—Mains and Feeders; Percentage of Loss—House Wiring: The Tree System; The Closet System; Transformer System for Distributing Incandescent Lamps—Calculation of Conductors: Two-Wire System; Three-Wire—Ground Detectors; Proper Insulation Resistance for Lines; Testing of—Arc Lamps for Incandescent Circuits; Choke Coils; Cross Suspensions and Mast Arms for Street Lighting—Testing Arc Lines—Lightning Arresters and Transformers—Transformers in Series; Parallel; Safety Devices — Underground Wiring: Conduits; Manholes—Cables: Joints; Inductive Discharges; Terminals for Cables—The Testing of Underground Conductors: Capacity; Open and Short Circuits; Examples—The Central Station: Location—Design; Output; Load Factor—Proper Foundations; Shafting; Belting; Switch Boards; Dynamos; Engines and Boilers; Chimneys—Weight of Coal per Horsepower per Hour: Calculations of: Foundations for Dynamos; Shafting; Belting; Size of Pulleys—Switch Boards: Design; Erection—Installing Dynamos and Motors—The Locating and Curing of Faults in Dynamos and Motors: Short Circuits; Sparking at Commutator; Heating or Noise in Bearings—Installation of Dynamos for Arc Lighting—Installation of Dynamos for Incandescent Lighting—Shunt Wound Constant Potential Dynamos in Parallel—Alternating Current System for Incandescent Lighting; Alternators in Parallel; Station Connections—Installation for Constant Potential Motors: Compound Wound Dynamos in Parallel—Management of Station: Daily Records; Faults on the Line; The Checking of Instruments—Long Distance Transmission of Power; Economy of High E. M. F.'s; Example—Electric Street Railways: Trolley System; Central Stations—Load on Electric Railway Stations: Engines, Boilers and Generators; Ratio Between the Maximum and Average Load; Examples for Practice—The Use of Counter Shafts; Belts; Switch Board Connections—Cars and Car Equipment: Controllers; Trolley Pole and Stand; Electric Car Heater—Methods of Speed Control: Strength of Magnetic Field; Series Parallel Controller—Motor Connections and Car Wiring—Line Construction for Electric Railways: Poles; Span Wires—Calculation of Feeders and Trolley—Erection of the Line: Hangers; Pull-Offs; Ears; Strain Insulators; Mechanical Clips; Switches; Cross-Overs; Branch Lines; Curves; Feeder Taps; Guys—The Track—Electric Locomotives: High Speed Service—Underwriters' Rules.

Mensuration and Use of Letters in Algebraic Formulas.

Formulas—Lines and Angles—Equilaterals: Definitions of Various Equilaterals; Rules for Calculating Areas and Perimeters of Equilaterals—Triangles: Definitions of the Various Triangles; Rules for Calculating Areas and Perimeters of Triangles—Polygons: Definitions of the Various Polygons; Rules for Calculating Areas and Perimeters of Polygons—Circles: Rules for Finding Periphery and Area of Circles; Area of a Segment—The Prism and Cylinder:

Rules for Finding the Area of the Convex Surface, Entire Surface and Volume of a Prism or Cylinder—Pyramid and Cone : Rules for Finding the Area of the Convex Surface, Interior Surface and Volume of a Pyramid or Cone ; Frustum of Pyramid or Cone ; The Sphere : Rules for Finding the Area and the Volume of a Sphere.

Mechanics.

Matter and its Properties—Ductility—Motion and Velocity—Uniform and Variable Velocity—Force—Newton's Three Laws of Motion—To Find the Center of Gravity of a System of Bodies—To Find the Center of Gravity of an Irregular Plane Figure—Straight and Bent Levers—The Compound Lever—Application of the Simple to the Compound Lever—The Wheel and Axle—Examples for Practice—Pulleys—To Find the Diameter of the Driving Pulley when the Diameter of the Driven Pulley and the Number of Revolutions per Minute of Each are Given—To Find the Number of Revolutions per Minute of the Driven Pulley, its Diameter and the Diameter and Number of Revolutions per Minute of the Driving Pulley being Given—The Diameter and Number of Revolutions per Minute of the Driver being Given, to Find the Diameter of the Driven which Must Make a Given Number of Revolutions per Minute—To Find the Number of Revolutions per Minute of the Driver, its Diameter, and the Diameter and Number of Revolutions per Minute of the Driven Pulley being Given—Gear Wheels—Worm and Worm Wheels—To Find the Pitch Diameter of a Gear Wheel when the Pitch and Number of Teeth are Given—To Find the Number of Teeth in a Gear Wheel when the Diameter and Pitch are Given—To Find the Pitch of a Gear Wheel When the Diameter and the Number of Teeth are Given—To Calculate the Number of Teeth or Speed of Two Gear Wheels which are to Gear Together—The Number of Revolutions per Minute of the Driver and Driven, and the Number of Teeth in the Driver being Given, to Find the Number of Teeth in the Driven—The Number of Teeth in the Driver and Driven, and the Number of Revolutions per Minute of the Driver being Given, to Find the Number of Revolutions per Minute of the Driver—The Number of Teeth in the Driver and Driven, and the Number of Revolutions per Minute of the Driven being Given, to Find the Number of Revolutions per Minute of the Driver—Examples Illustrating the Calculating of the Size of the Governor Pulleys, the Number of Revolutions of the Line Shafting, Together with the Sizes of the Pulleys on it, also the Number of Revolutions and Sizes of the Pulleys of Counter Shafts and the Number of Revolutions and Number of Teeth of Gear Wheels—Examples for Practice—The Block and Tackle—The Inclined Plane—To Find the Power Required to Raise a Given Weight up an Inclined Plane—The Wedge—The Screw—To Find the Weight which a Screw Will Lift, or the Force Necessary to Raise a Given Weight—Friction—Laws of Friction—Table of Coefficients of Friction—Examples for Practice—To Find the Centrifugal Force of a Revolving Body, such as Fly Wheels, Band

Mechanics, Continued.

Wheels, etc.—Table of Specific Gravity and Weight per Cubic Foot in Pounds of Metals, Woods, Liquids, and Gases, also of Miscellaneous Substances—Application of Table of Specific Gravity—Examples for Practice—Work—To Find the Horse Power Required to Raise a Given Weight a Given Height in a Given Time—Energy—Leather and Rubber Belts—To Find the Width of a Leather Belt that Will Transmit any Given Horse Power—To Find the Horse Power that a Leather Belt will Transmit—To Find the Horse Power that May be Transmitted by Gear Wheels—Examples for Practice.

Hydrostatics—Pascal's Law—Downward Pressure—Upward Pressure—Lateral or Sideways Pressure—Principles of Hydraulic Machines—Illustrated Examples Showing How to Calculate in a Hydrostatic Press the Power Necessary to Raise a Given Load—Buoyant Effects of Water.

Pneumatics—The Atmosphere—The Vacuum—The Barometer—To Find the Pressure of a Gas After it has been Compressed to a Given Volume—To Find the Volume of a Gas when it has been Compressed to a Given Pressure—Pneumatic Machines—The Air Pump—The Receiver—Explanations of the Principles of the Dash Pot—Air Compressors—The Siphon—The Injector—The Suction Pump—The Lifting Pump—Force Pumps—Plunger Pumps—Air Chambers—Steam Pumps—Duplex Pumps.

Strength of Materials—The Elastic Limit—Tensile Strength of Materials—To Find the Load that may Safely be Put on a Rod Under Tension—To Find the Size of the Rod Required to Sustain a Given Load Under Tension—Strength of Chains—Strength of Hemp Ropes—Strength of Wire Ropes—To Find the Diameter of a Wire Rope—Crushing Strength of Materials—To Find the Strength of Pillars—Transverse Strength of Beams—Shearing or Cutting Strength of Materials—Line Shafting—To Find the Proper Distances between the Hangers for Line Shafting—To Compute the Horse Power that can be Transmitted by a Shaft of a Given Diameter—To Compute the Diameter of a Shaft that will Transmit a Given Horse Power.

Geometrical and Mechanical Drawing.
(Shorter Courses.)

Drawing Instruments and Materials—To Sharpen the Drawing Pen—The Scale—The Protractor—Lettering—Guide Lines—Examples of Lettering—Hints in Lettering—Practical Geometry—To Bisect a Given Straight Line—To Draw a Perpendicular to a Straight Line—To Draw a Straight Line Parallel to a Given Straight Line—To Bisect a Given Angle—To Divide a Given Straight Line into any Required Number of Equal Parts—Given a Straight Line, to Make any Required Angle with that Line—To Construct Triangles—To Draw a Parallelogram—An Arc and its Radius being Given to Find the Center—To Divide a Circle into a Given Number of Equal Parts—The Side of a Regular Polygon being Given to Construct the Polygon—To Draw an Ellipse—To Draw a Helix—The Representation of Objects—Projection Drawing—The Top View or Plan—The Front View or Front Elevation—The Side

Geometrical and Mechanical Drawing, Continued.

View or Side Elevation—Rectangular Prism—Triangular Prism--Hexagonal Prism—Hexagonal Pyramid—Spherical Headed Rivet—Square Headed Bolt—Cylindrical Flanged Distance Piece—Cylindrical Ring—Rectangular Prism in a Foreshortened Position—Hexagonal Prism in a Foreshortened Position—Hexagonal Pyramid in a Foreshortened Position—Cylinder in a Foreshortened Position—Intersections—To Draw the Template for the Dome of a Boiler—To Draw the Template for a Miter Elbow—To Draw the Templates for a Three-Joint Right Angle Elbow—To Draw Templates which when Cut Out and Bent will Form a Cone, Frustrum of a Cone or any Part of a Cone—The Conventional Methods of Representing Screw Threads—To Draw Single Threaded Screws—To Draw Double Threaded Screws—To Make a Working Drawing in Elevation and Section of a 6½-Inch Diameter Hand Wheel—To Make a Working Drawing of a Crank—To Make a Working Drawing in Elevation and Section of a 14 Ft. Band Wheel—To Make a Working Drawing in Elevation and Section of an Eccentric and Strap—To Make a Working Drawing of a Brake Lever—To Make a Working Drawing in Front Elevation and End Elevation of a Reversing Brake Lever with Stand—To Make a Working Drawing in Sectional Elevation of a 5-Inch Globe Valve—To Make a Working Drawing of a Boiler Setting for a Nest of Three 54-Inch Diameter by 15 Feet Long Return Tubular Boilers—All the Parts of a Six Horsepower Steam Engine having been Sketched and Measured, and all the Necessary Dimensions Written in the Sketches, to Draw in Plan and Side Elevation the Steam Engine from these Sketches—Tracings—Blue-Printing—Preparing the Paper—Blue-Print Frames—Time of Exposure—Washing and Drying.

Dynamos and Motors.

Electricity: Nature; Sources and Detection—Electrostatics; Positive and Negative Charges; Attraction and Repulsion—Electric Series—Conductors and Non-Conductors—Electro-Dynamics: Potential and Flow of Currents—Voltaic Cell: Voltaic Battery; Electrodes; Positive and Negative Elements — Electromotive Series — Difference Between Electric Currents and Static Charges—Methods of Connecting Voltaic Batteries: Series; Multiple; Series-Multiple—Circuits: Open; Closed; Grounded; External and Internal—Conductors in Series: In Parallel; Derived Circuits—Magnetism: Natural and Artificial Magnets; Poles of a Magnet; The Compass; Attraction and Repulsion Between Magnets—Magnetism of the Earth—Magnetic and Non-Magnetic Substances—The Magnetic Field; Lines of Force—Magnetic Induction: Amount and Density of Magnetism—Electro-Magnetism; Magnetic Field Surrounding a Current—Solenoid; Polarity of a Solenoid—Magnetic Permeability—Various Forms of Electro-Magnets—Electrical Units: The Ampere, the Ohm and the Volt; Electromotive Force; Ohm's Law—The Ampere; Methods of Measuring Current — Galvanometer — The Ohm; The Resistance of Conductors of Different Lengths

Dynamos and Motors, Continued.

and Areas ; Examples — Microhm — Temperature Coefficient—The Change in Resistance of a Conductor due to a Change in the Temperature—Specific Resistance : Table of Specific and Relative Resistances, and the Temperature Coefficients of Various Metals—Resistance of Liquids—Resistance Boxes—Measurement of Resistances : Wheatstone Bridge—Measurement of Electromotive Force—Voltmeters : Cardew Voltmeter ; Weston Voltmeter—Applications of Ohm's Law to Closed Circuits : Rules for Finding any one of the Three Quantities, Current, Resistance, and Electromotive Force, the other two being Known—External and Internal Electromotive Force of Cells—Conductivity : Rules and Formulas for the Amount of Current in Circuits of Two or More Branches—Derived Units—Electrical Quantity ; The Coulomb—Electrical Work : The Joule ; Its Mechanical Equivalent—Electrical Power : The Watt ; The Electrical Power Expended in Circuits—Induced Currents : Electro-Magnetic Induction ; Self-Induction ; Mutual Induction ; The Direction of an Induced Current—Theory of the Dynamo—E. M. F. Induced in a Coil Revolving in a Magnetic Field ; Graphical Representation of the E. M. F.—Alternating Currents ; Commuting Alternating Currents to Continuous Currents ; Commutator ; Pulsating Currents—Armature Cores ; Ring and Drum Cores—Closed Coil and Open Coil Windings—The Amount of the E. M. F. Generated in an Armature Winding : Armature Reactions ; Counter Torque of a Dynamo—Effect of the Current in the Armature Winding ; Distortion of the Field—Field Magnets : Excitation of—Magnetizing Force ; Ampere Turns—Magnetic Saturation ; Limits of Magnetization—Shunt Dynamo—Series Dynamo—Compound Wound Dynamo—Methods of Regulating ; Overcompounding—Types of Bipolar Field Magnets—Types of Dynamos : Constant Potential ; Multipolar Field Magnets ; Multipolar Armature Windings—Mechanical Construction of Dynamos ; Modern Bipolar and Multipolar Dynamos—Details : Frame ; Armature ; Commutator Brushes and Brush Holders ; Journals ; Driving Mechanism —Efficiency of Constant Potential Dynamos—Distribution of Losses: Mechanical Losses; Core Loss; Field Loss; Armature Loss; Percentage of the Various Losses—Output of Constant Potential Dynamos—Heating—Sparking : Shifting of Brushes ; Carbon and Metallic Brushes—Constant Current Dynamos—Regulating E. M. F. of Dynamo to get Constant Current—Closed Coil Windings : Wood Dynamo ; Western Electric Dynamo ; Excelsior Dynamo ; Ball Dynamo—Open Coil Windings : Brush Dynamo ; Westinghouse Dynamo—Thomson-Houston Dynamo—Output of Constant Current Dynamos—Alternating Current Dynamos : Cycle ; Frequency—Graphical Method of Representing Alternating Currents—Alternators : Principles of Winding ; Width of Coils and Fields—Multipolar Alternators : Ring and Drum Windings ; Toothed Armatures—Methods of Exciting Alternator Fields ; Compound Winding—Internal Connections of Alternator Armatures—Multiphase Alternators—Phase Difference ; Adding Two Alter-

Dynamos and Motors, Continued.

nating Currents that Differ in Phase—Two and Three-Phase Alternators ; The Armature Windings—Properties of the Alternating Current : Effective Current and E. M. F. ; Lag ; Self-Induction and its Effect—Transformers ; Primary and Secondary Coils ; Self-Induction ; Losses and Efficiency of Transformers—Motors—Interchangeability of Dynamos and Motors—General Classification of Motors —Torque ; Counter E. M. F. ; Starting Resistance ; Automatic Regulation of the Torque—Field Magnets of Motors : Shunt Motors ; Constant Speed Motors—Series Motors ; Variations of Speed ; Reversing ; Connections of Motors —Output of Constant Potential Motors : Efficiency and Losses—Constant Current Motors—Alternating Current Motors—Single Phase Motors : Synchronism ; Slip—Multiphase Motors : The Rotary Field ; Speed of Rotation of Rotary Field ; Starting Torque ; Slip ; Speed Regulation —Synchronous Multiphase Motors—Output of Alternating Current Motors : Effect of Armature Reaction—Installation and Care of Dynamo-Electric Machinery : Location ; Foundations—Belting—Setting up Direct Current Dynamos ; Starting ; Locating and Remedying Faults ; Sparking ; Heating ; Short Circuits ; Open Circuits—Care of Dynamos—Arc Machines : Care and Management—Direct Current Motors : Installing ; Starting ; Locating Faults ; Care—Alternating Current Dynamos : Setting up ; Locating and Remedying Faults ; Exciters—Alternating Current Motors : Installing—Switch Boards ; General Construction ; Arrangement—Dynamos in Parallel—Bus-Bars : Instruments : Safety Devices—Switch Boards for Lighting Plants : For Railway and Power Plants : For Arc Lighting Systems : For Alternating Current Systems.

Electric Lighting.

Methods of Electric Lighting—Incandescent Lamps : Construction of ; Connections : Efficiency ; Heating ; Regulation ; Life—Arc Lamps—Principles of the Electric Arc ; Counter E. M. F. ; Source of the Light ; Temperature of the Arc ; Candle-Power ; Distribution of the Light—Lighting by "Inverted" Arcs—Efficiency—Wearing Away of Carbons : Life ; Solid and Cored Carbons—Mechanism for Feeding : Operation ; Shunt and Series Coils ; Starting Coils—Cut-Outs ; Regulation ; Clutch and Rack Mechanism—Double Carbon Lamps—"Enclosed" Arcs—Arc Lamps for Alternating Currents—Projectors—Lighting Systems : Series and Parallel Distribution : High and Low Voltage—Direct Currents—Alternating Currents—Central Stations for Electric Lighting : Location of the Station and the System to be Used—District to be Served ; Availability of Coal and Water Supplies ; Character of the Station Load Line—Arrangement of the Station—Kind and Sizes of Apparatus : Boilers, Engines and Dynamos ; Reserved Plant—Use of Storage Batteries—Arrangement of Interior of Station : Efficiency of Operation : Distribution of Current ; Losses in Distribution ; Equalizing of Pressure ; Centers of Distribution—Calculations for Sizes of Wire Necessary : Tables of Standard Sizes, Weight, Resistance, etc., of Bare and Insulated Copper Wire—In-

Electric Lighting, Continued.

crease in Apparent Resistance of Alternating Current Circuits—Special Features—Overhead Construction Work: Location of Pole Line; Sizes, Lengths, etc., of Standard Poles; Setting Poles: Cross-Arms, Pins, Braces, Insulators, etc.—Guying Poles; Curves and Corners—Stringing Wires: Allowance for Sag; Special Work in Trees and on Roofs—Care of Pole Lines—Street Lighting—Arc Lighting Circuits: Location of Arc Lamps; Cross Suspension; Mast Arms; Wiring—Incandescent Lamps for Street Lighting: Advantages; Methods of Operating; Series Lamps—Incandescent Street Lamp Fixtures and Other Appliances—Underground Distribution: Conduits; Manholes; Drawing in Cables; Care and Maintenance—Transformer Systems: Large Transformers; Sub-Stations—Interior Wiring: Distribution; Series; Two-Wire, Three-Wire and Flexible Two-Wire Systems—Equalizing of Potentials at the Lamps; Centers of Distribution—Location of Switches: Cut-Outs; Risers; Mains; Circuit Wires—Insulation of Wires for Interior Wiring—Running the Wires: High Tension Circuits—Open Work; Knobs and Cleats; Spacing of Wires—Methods of Passing Through Floors and Partitions—Open Wiring in Completed Buildings—Wiring in Buildings in Process of Construction—Concealed Wiring: Molding; Conduits; Armored and Plain Conduits; Conduits for Alternating Current Circuits—Junction Boxes; Cut-Outs; Fishing Wires—Loop System of Wiring: General Arrangement of Conduits; Meters and Other Appliances—Use of Arc Lamps on Incandescent Circuits—Interior Wiring for Stationary Motors—Fire Underwriter's Rules and Their Application to Exterior and Interior Wiring.

Electric Railways.

The Electric Motor on Street Cars—Storage Batteries: Results Obtained in Practice—Underground Trolley or Conduit System: Closed and Open Conduits—Overhead Trolley System: Series and Parallel Distribution—Alternating Currents Applied to Electric Railways—The Selection of a Street Railway System: Rolling Stock; Open and Closed Cars; Vestibule Cars; Four, Six and Eight Wheel Trucks—Street Railway Motors—Car Wiring—Trolleys—Controlling Motors: Rheostatic and Series-Parallel Controllers—Power Required for Cars—Traction Coefficient: Effect of Grades and Curves—Current Consumption—Heating and Lighting Cars—The Power Station: Location; Operation; Distant Sources of Power—Arrangement of the Station and Size of the Units—Various Types of Engines for Street Railway Service: Comparison Between Lighting Station and Power Station—Details of Power Station—Use of Storage Batteries: The External Circuit—Method of Distribution: Feeders; Calculation of Size of Feeders and Position of Feeding Points—The Feeder Line: Poles; Insulators, Cross-Arms and Other Appliances; Underground Conduits for Feeders—The Trolley Wire: Size and Materials; Bracket and Center Pole Suspension; Span Wire Suspension—Erecting Span Wires; Sag of Span and Trolley Wires—Trolley Wire Insulators: Mechanical Clips

Electric Railways Continued.

—Guard Wires—Stringing Trolley Wires ; Tower Wagons and Other Appliances—Switches and Cross-Overs ; Section Insulators ; Locating Switches ; Anchoring Line at Curves and Crossings—Single and Double Tracks ; The Return Circuit ; Rail Return—Rail Bonding ; Supplementary Wires ; Return Feeders—Prevention of Electrolysis of Gas and Water Mains—Track Construction : Rails ; Chairs ; Joints—Fish Plates and Bridge Joints ; Continuous Rails —Turnouts on Single Tracks—Construction of Conduit Roads—Maintenance of System : Care of Overhead Appliances ; Care of Motors and Electrical Equipment ; Inspection ; Locating and Remedying Faults—Care of Roadway ; Repairing Joints ; Removal of Snow and Ice ; Management of Road—Line and Track Construction on Elevated Electric Railways—Other Applications of Electric Motors to Haulage.

Electric-Light Wiring and Bell Work.

House Wiring for Electric Lighting—Methods of Wiring—Series—Parallel—Systems of Parallel Wiring—Two-Wire System—Three-Wire System—Feeders—Risers—Mains—Circuits—Wires—Insulation—Table of Standard Sizes—Carrying Capacity—Calculations of Sizes of Wire Required —Methods of Running Wires—Cleats—Knobs—Molding—Interior Conduits—Exposed and Concealed Work—Wiring in Old Buildings—In Buildings in Process of Construction —Safety Devices—Location and Grouping of Cutouts—Main Branch and Bug Cutouts and Rosettes—Switches—Location and Grouping—Joints—Branch Circuits—Fixtures—Electroliers—Combination Gas and Electric Fixtures—Insulating Joints—Outside Wiring—Overhead—Underground (Fire Service Wires)—Transformer Installation—Wiring to Outside Lights—To Adjacent Buildings —Incandescent Lamps—Incandescent Arc Lamps—Sockets—Wall Receptacles—Attaching Plugs—Testing Circuits —Underwriters' Rules for Wiring—Outline Description of an Isolated Lighting Plant of 300 Lights—Engines—Dynamos—Switchboard—Connection of Circuits to Switchboard —Electric Bell Work—Speaking Tubes—Bells—Buzzers—Push-Buttons—Systems of Wiring—Wires—Methods of Running Wires—Concealed Work—Flat-House Equipments—Electric Door Openers—Annunciators—Return Signal Annunciators — Elevator Annunciators — "Teleseme" Messenger Service—Batteries—Kind and Number to Use—Care—Use of Dynamo Current—Electric Gas Lighting—Direct or Parallel System—Ratchet Burners—Automatic Burners—Series System—Friction Machines—Induction Coils—Method of Wiring Burners.

SAMPLE PAGES OF INSTRUCTION AND QUESTION PAPERS.

We do not send out Instruction and Question Papers for examination. Intending students can learn how they are written and illustrated and the subjects treated in them, from the following sample pages.

Sample Page of Instruction Paper. Subject—Arithmetic.

309. A ratio may be squared, cubed or raised to any power, or any root of it may be taken. Thus, if the ratio of two numbers is $105 : 63$, and it is desired to cube this ratio, the cube may be expressed as $105^3 : 63^3$. That this is correct is readily seen; for, expressing the ratio in the fractional form, it becomes $\frac{105}{63}$, and the cube is $\left(\frac{105}{63}\right)^3 = \frac{105^3}{63^3} = 105^3 : 63^3$. Also, if it is desired to extract the cube root of the ratio $105^3 : 63^3$ it may be done by simply dividing the exponents by 3, obtaining $105 : 63$. This may be proved in the same way as in the case of cubing the ratio. Thus, $105^3 : 63^3 = \left(\frac{105}{63}\right)^3$, and $\sqrt[3]{\left(\frac{105}{63}\right)^3} = \frac{105}{63} = 105 : 63$.

310. Since $\left(\frac{105}{63}\right)^3 = \left(\frac{5}{3}\right)^3$, it follows that $105^3 : 63^3 = 5^3 : 3^3$ (this expression is read: the ratio of 105 cubed to 63 cubed equals the ratio of 5 cubed to 3 cubed), it follows that the antecedent and consequent may always be multiplied or divided by the same number, irrespective of any indicated powers or roots, without altering the value of the ratio, providing that both antecedent and consequent have the same exponents. Thus, $24^2 : 18^2 = 4^2 : 3^2$. For, performing the operations indicated by the exponents, $24^2 = 576$ and $18^2 = 324$. Hence, $576 : 324 = 1\frac{7}{9}$ or $1\frac{7}{9} : 1$. Also, $4^2 = 16$ and $3^2 = 9$; hence, $16 : 9 = 1\frac{7}{9}$ or $1\frac{7}{9} : 1$, the same result as before. Also, $24^2 : 18^2 = \frac{24^2}{18^2} = \left(\frac{24}{18}\right) = \left(\frac{4}{3}\right)^2 = \frac{4^2}{3^2} = 4^2 : 3^2$.

The statement may be proved for roots in the same manner. Thus $\sqrt[3]{24^3} : \sqrt[3]{18^3} = \sqrt[3]{4^3} : \sqrt[3]{3^3}$. For the $\sqrt[3]{24^3} = 24$ and $\sqrt[3]{18^3} := 18$; and, $24 : 18 = 1\frac{1}{3}$ or $1\frac{1}{3} : 1$. Also, $\sqrt[3]{4^3} = 4$ and $\sqrt[3]{3^3} = 3$; $4 : 3 = 1\frac{1}{3}$ or $1\frac{1}{3} : 1$.

Sample Page of Instruction Paper. Subject—Elementary Mechanics.

FRICTION.

Friction is the resistance that a body meets from the surface on which it moves.

The ***ratio*** between the *resistance* to the motion of a body due to friction, and the *perpendicular* pressure between the surfaces, is called the ***coefficient of friction.***

If a weight W, as in Fig. 47, rests upon a horizontal plane, and has a cord fastened to it passing over a pulley a, from which a weight P is suspended, then, if P is just sufficient to start W, the ratio of P to W, or $\frac{P}{W}$ is the *coefficient of friction* between W and the surface it slides upon.

The weight W is the perpendicular pressure, and P is the force necessary to overcome the resistance to the motion of W due to friction.

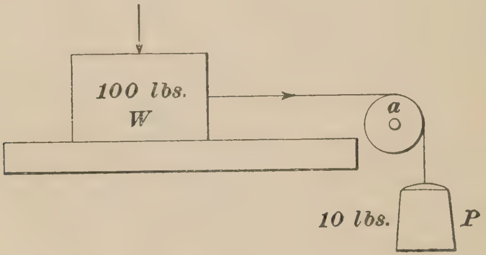


FIG. 47.

If $W = 100$ pounds and $P = 10$ pounds, the coefficient of friction for this particular case would be $\frac{P}{W} = \frac{10}{100} = .1.$

Laws of Friction :—

I. *Friction is directly proportional to the perpendicular pressure between the two surfaces in contact.*

II. *Friction is independent of the extent of the surfaces in contact when the total perpendicular pressure remains the same.*

III. *Friction increases with the roughness of the surfaces.*

IV. *Friction is greater between surfaces of the same material than between those of different materials.*

V. *Friction is greatest at the beginning of motion.*

Sample Page of Instruction Paper. Subject—Pneumatics.

The Hydraulic Ram.—The machine shown in Fig. 26 is used for raising water from a point below the level of the water in a spring or reservoir to a point considerably higher, with no power other than that afforded by the inertia of a moving column of water. *a* is a pipe connecting the ram with the reservoir, and is called the *drive pipe;* the valve *b* slides freely in a sleeve *h*, which has a regulating screw attached so that the drop of the valve may be regulated to suit. The valve is heavier than the pressure of the water against it; consequently, it falls and the water flows out through the opening at *c*. As the discharge continues the velocity of the water in the drive pipe increases and also the upward pressure against the valve *b*, which soon becomes sufficient to close it suddenly.

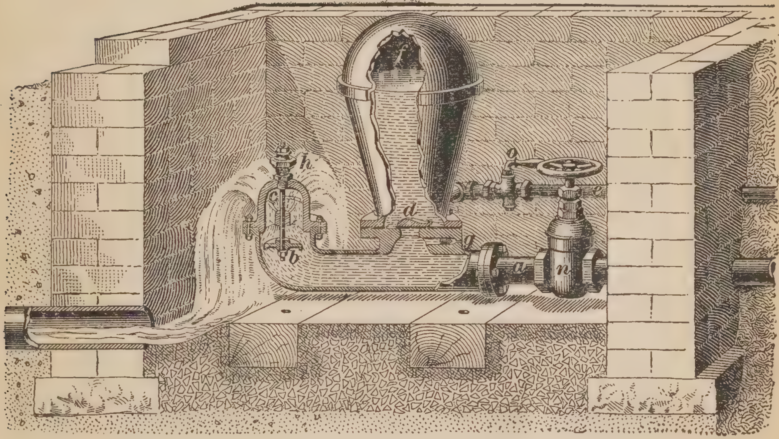


FIG. 26.

The force exerted by this moving body of water, owing to its being suddenly brought to rest by the closing of the valve *b*, is enormous, though brief; this brief but heavy pressure forces the valve *d* open and a quantity of water enters the air chamber *f*.

Sample Page of Instruction Paper. Subject—Heat.

If the air thus compressed could be used at once, there would be no loss, since the heat imparted to it would be utilized in doing work, and it would make no difference whether the compression was adiabatic or isothermal. Such is not the case, however. The air after leaving the compressor is stored in a large reservoir called a ***receiver,*** from which it is conveyed in pipes to the engines, pumps, or other machines which it operates. These are situated sometimes 5 miles or more from the compressor, and when the air reaches them, its temperature has been reduced to that of the atmosphere. As a consequence of this reduction in temperature, the pressure falls to a point determined by the intersection of an ordinate drawn through the point W and the isothermal curve $E B A$. Fig. 18 shows the curves when applied to an air compressor. $O L$ represents the initial volume, say, 5 cu. ft.; $L B$ the atmospheric pressure, 14.7 pounds per square inch, and $O H$, the final pressure, say, 100 pounds per square inch. $B C$ represents the adiabatic and $B A$ the isothermal compression curve, respectively.

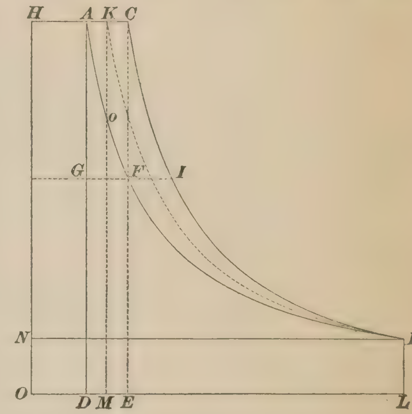


FIG. 18.

The point F where the ordinate through C intersects the isothermal $B A$ indicates the pressure of air, when compressed adiabatically after it has cooled to the temperature of the outside air. Measuring the ordinate $E F$, the pressure at the point is found to be 57.26 pounds per square inch.

The work done in compressing the air adiabatically and in forcing it out of the cylinder is proportional to the area $B L O H C$, while for isothermal compression, the work is proportional to the area $B L O H A$. The work lost through adiabatic compression is the difference of these two areas or the area $A B C$. By the use of some cooling device, such as the water jacket described in Instruction Paper, subject, Pneumatics,

Sample Page of Question Paper. Subject—Arithmetic.

(12) From 5,962 + 8,471 + 9,023 take 3,874 + 2,039.

Ans. 17,543.

(13) A man willed $125,000 to his wife and two children; to his son he gave $44,675; to his daughter $26,380, and to his wife the remainder. What was his wife's share?

Ans. $53,945.

(14) Find the products of the following:
(*a*) 526,387 × 7; (*b*) 700,298 × 17; (*c*) 217 × 103 × 67.

Ans. (*a*) 3,684,709.
(*b*) 11,905,066.
(*c*) 1,497,517.

(15) If your watch ticks once every second, how many times will it tick in one week? Ans. 604,800 times.

(16) If a monthly publication contains 24 pages in each issue, how many pages will there be in eight yearly volumes?

Ans. 2,304.

(17) An engine and boiler in a manufactory are worth $3,246. The building is worth three times as much plus $1,200, and the tools are worth twice as much as the building, plus $1,875. (*a*) What is the value of the building and tools? (*b*) What is the value of the whole plant?

Ans. (*a*) $34,689.
(*b*) $37,935.

(18) Solve the following by cancellation:

(*a*) $\frac{72 \times 48 \times 28 \times 5}{96 \times 15 \times 7 \times 6} = ?$ (*b*) $\frac{80 \times 60 \times 50 \times 16 \times 14}{70 \times 50 \times 24 \times 20} = ?$

Ans. (*a*) 8.
(*b*) 32.

(19) If a mechanic earns $1,500 a year for his labor, and his expenses are $968 per year, in what time can he save enough to buy 28 acres of land at $133 an acre. Ans. 7 years.

(20) A freight train ran 365 miles in one week, and 3 times as far, lacking 246 miles, the next week; how far did it run the second week? Ans. 849 miles.

Sample Page of Instruction Paper. Subject—Algebra.

ADDITION OF MONOMINALS.

There are two cases, according as the terms to be added are like or unlike. (Art. ***18.***)

41. Like Terms.—To add like terms having the same sign:

Rule I.—*Add the coefficients, prefix the common sign to their sum, and annex the common symbols.*

To add like terms, some positive and some negative:

Rule II.—*Add the coefficients of the positive and negative terms separately, and subtract the less sum from the greater. Prefix the sign of the greater sum to the result, and annex the common symbols.*

EXAMPLE.—Find the sum of $-2abxy$, $-abxy$ $-3abxy$ and $-6abxy$.

SOLUTION.—The sum of the coefficients is 12 (remember that the coefficient of $-abxy$ is 1), and the common sign is —. The common symbols $abxy$ annexed to these give, as the result, $-12abxy$. (Rule I.)

EXAMPLE.—Combine xy^2, $-2xy^2$, $8xy^2$ and $-4xy^2$.

SOLUTION.—The sum of the coefficients of the positive terms is 9, and of the negative terms, 6. Their difference is 3, and the sign of the greater sum is +. The common symbols xy^2 annexed to these give, as the result, $3xy^2$. (Rule II.)

42. Unlike Terms.—In arithmetic, unlike numbers, as 5 books and 6 dollars, cannot be added. So, in algebra, unlike terms, as $3ab^2$, $3a^2b$, $-4xy$, etc., cannot be combined into one term, and their sum can only be indicated by connecting the terms by their respective signs. (Art. ***40.***) This is another illustration of the fact stated in Art. ***36,*** that operations with letters cannot always be performed. Expressions in algebra are composed of quantities between which operations of addition, multiplication, etc., are indicated. The trinomial $m^2 - 2mn + n^2$, for example, is the indicated sum of m^2, $-2mn$ and n^2, *but it is to be considered as one quantity in the same way that an arithmetical sum, obtained by actually performing the addition is*

Sample Page of Instruction Paper. Subject—Geometry and Trigonometry.

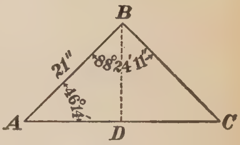
OBLIQUE TRIANGLES.

When three parts of *any* triangle are given, one being a side, the remaining parts can be found by means of right-angled triangles by drawing a perpendicular from one angle to the opposite side. The parts of these triangles can then be computed, and from them, the parts of the required triangle can be found.

CAUTION.—*When dividing the triangle into two right-angled triangles, care must be taken that the perpendicular be so drawn that one of the right-angled triangles will have two known parts besides the right angle; otherwise the triangle cannot be solved.*

Case I.—*When the three known parts are a side and two angles, or an angle and two sides.*

EXAMPLE.—In the figure, the angle $A = 46° 14'$, the angle $B = 88° 24' 11''$, and the side $A B = 21$ in.; to find $A C$, $B C$, and the angle C.



SOLUTION.—Since the sum of all the angles of any triangle = 2 right angles, or 180°, we can find the angle C by adding the two known angles and subtracting their sum from 180°.

$$88° \; 24' \; 11'' + 46° \; 14' = 134° \; 38' \; 11''.$$
$$180° - 134° \; 38' \; 11'' = 45° \; 21' \; 49'' = C.$$

From the vertex B, draw $B D$ perpendicular to $A C$. The triangle $A B C$ is now divided into two right-angled triangles, $A D B$ and $B D C$.

In the right-angled triangle $A D B$, the angle A, the right angle D and the hypotenuse $A B$ are known; to find $B D$ and $A D$. Use rule **2**; side opposite, or $B D = 21 \times \sin 46° \; 14' = 21 \times .72216 =$ 15.17 in., nearly.

Use rule **4**; side adjacent, or $A D = 21 \times \cos 46° \; 14' = 21 \times .69172$, or $A D = 14.53$ in., nearly.

In the right-angled triangle $B D C$ the angle C and the side opposite, or $B D$, are known; to find $B C$ and $D C$.

Use rule **7**; hypotenuse, or $B C = \dfrac{B D}{\sin 45° \; 21' \; 49''} = \dfrac{15.17}{.71158} = 21.32$ in., nearly.

Sample Page of Instruction Paper. Subject—Steam and Steam Engines.

STEAM CONSUMPTION.

This indicator card also enables us to find approximately the amount of steam consumed by the engine. In referring to the steam consumption, it is customary to take as a unit, the *steam consumed per horsepower per hour.*

Take a point *a* on the expansion line before the release (see Fig. 43); measure the pressure from the vacuum line, and from column 8, of the steam table, find the weight of a cubic foot at that pressure. The cubic contents of the cylinder (including the clearance) up to the point *a*, multiplied by the weight per cu. ft., must give the weight of steam in the cylinder at this instant. Were it not for compression and cylinder condensation, the above weight would represent the steam consumed per stroke. On account of compression, some steam is saved by the early closure of the exhaust port. To find its weight, take a point *b* on the compression curve, measure its pressure from vacuum as before, and compute the weight of the steam in the cylinder up to *b*. Subtract this from the weight first obtained, and the difference will be the weight of steam per stroke, accounted for by the indicator. Multiply this weight per stroke by the number of strokes per hour and divide by the I. H. P. of the engine. The result will be the steam used per I. H. P. per hour.

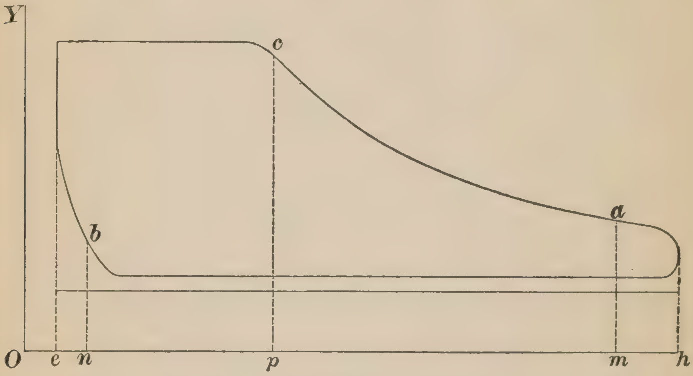


FIG. 43.

Sample Page of Instruction Paper. Subject—Applied Mechanics.

Sometimes a positive motion is secured with a plate cam by causing it to revolve between two rollers, rigidly connected as illustrated in Fig. 31. The rollers *A* and *E* turn upon pins in one end of the rod *R*. The rod is slotted between the rollers, so that the cam shaft may pass through it and still allow the rod to move to the right and left. The center line of motion of the rollers passes through the center *B* of the shaft, whatever the position of the cam or rod.

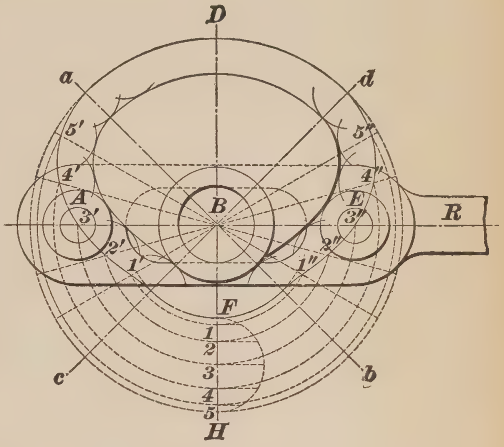


FIG. 31.

Let it be required that during one-quarter of a revolution of the cam, the rod shall move to the right or left, according to the position of the cam at the start; that during the next quarter, the rod shall be held stationary; that during the third quarter, it shall move to its original position, where it is to remain for the rest of the revolution.

Draw the line *D H*, and mark the point *B*. Lay off a distance *B F*, such that when the center of one of the rollers is at *F*, the hub of the cam will not interfere with the roller. Lay off the distance *F H*, beyond *F*, equal to the required movement of the rod. With *B* as a center and a radius equal to *B H*, describe a circle. Divide the circle into four quadrants by the lines *a b* and *c d*, making angles of 45° with *D H*, and with center *B*, and radius *B F*, strike an arc as shown. That part of the arc included in the lower quadrant, and that part of the outer circle included in the upper quadrant, form two parts of the required outline, and the distance between

Sample Page of Instruction Paper. Subject—Machine Design.

For the journal box shown in Fig. 7, the following proportions may be used for sizes of journals from $\frac{1}{2}''$ to $2''$ diameter inclusive. The diameter of shaft $d =$ the unit.

$a = 2.25\,d.$
$b = 1.75\,d.$
$c = d.$
$e = .375\,d.$
$f = .08\,d + .0625''.$

$m = .25\,d + .1875''.$
$n = .5\,d.$
$o = .625''$ (constant).
$p = 1.5\,d.$
$q = 1.333\,d.$

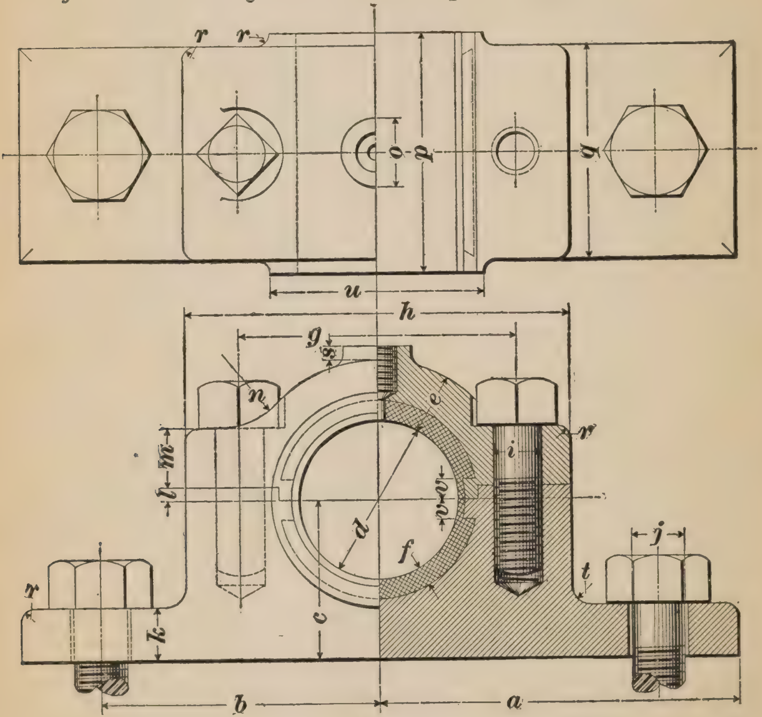


FIG. 7.

$g = 1.75\,d.$
$h = 2.45\,d.$
$i = .3\,d.$
$j = .33\,d.$
$k = .25\,d + .125''.$
$l = .08\,d.$

$r = .08\,d.$
$s = .125''$ (constant).
$t = .16\,d.$
$u = 1.333\,d.$
$v = .125\,d.$

Sample Page of Question Paper. Subject—Electrical Measurements.

(40.) A certain telegraph line has its poles 120 feet apart, and there are 440 poles.

The line is connected up to a resistance testing apparatus as represented in Fig. 9, in which *R* is a known resistance of 15,000 ohms; *G* is a standard tangent galvanometer; *B* is a battery; *K* is a switch which may make connection between the battery and either the resistance *R* or an earth connection *E*. On connecting with the earth plate the deflection of the galvonometer is 30° 30′; on connecting with the resistance *R* the deflection is 69°.

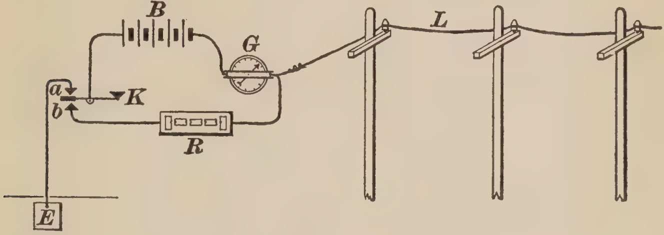


FIG. 9.

(*a*) What is the insulation resistance of the line in megohms?

(*b*) What is the insulation resistance in megohms per mile?

(*c*) What is the insulation resistance in megohms per pole?

Ans. (*a*) .06633 megohm.
(*b*) .6633 megohm.
(*c*) 29.2 megohm.

NOTE.—This method of testing resistance is *not* accurate within 1%.

(41.) What is a reflecting galvonometer?

(42.) (*a*) Draw a diagram showing a method of measuring the insulation resistance of a piece of wire with a bridge.

(*b*) With a Weston voltmeter.

Sample Page of Instruction Paper. Subject—Batteries.

From the Curve it appears that the accumulators are absorbing current (*i. e.*, being charged) from about 11:45 P. M. to about 4:30 P. M. (of the next day), while during the balance of the 24 hours the accumulators are giving out current, *i. e.*, discharging. The output of the Dynamos is nearly constant, at about 850 amperes, the output for the 24 hours being about 20,400 ampere-hours. The output of the station is 20,000 ampere-hours, the *average* output being about 835 amperes. This shows a loss in charging of 400 ampere-hours, which, allowing for slight overcharging, etc., is about right, as the capacity of the accumulator plant is 5,000 ampere-hours, about. This station would probably have installed three dynamos, each of about 450 amperes output, two of which would be kept running

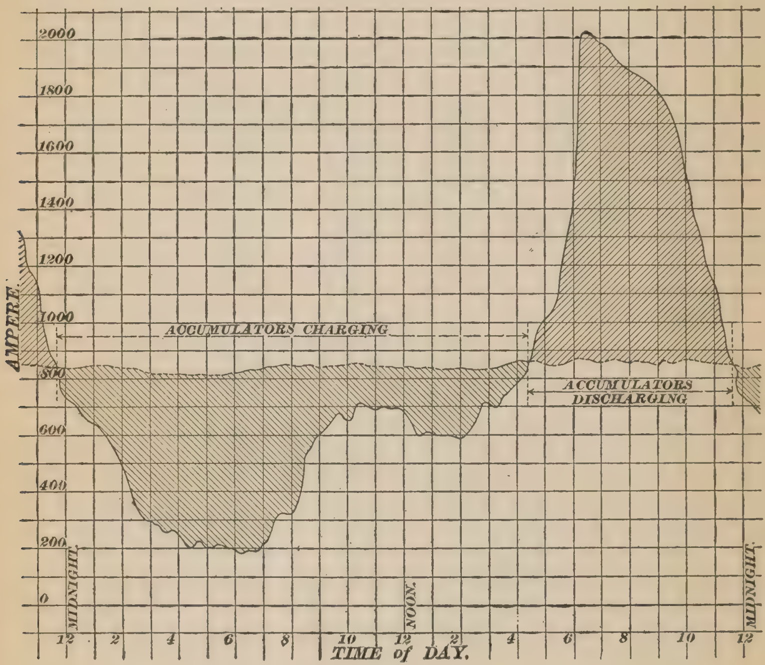


FIG. 29.

Sample Page of Instruction Paper. Subject—Power Transmission.

The countershaft is held on standards or pedestals placed on strong foundations under the engine room floor, as shown in the elevation, Fig. 19, where *f* is the engine flywheel, *p* the countershaft pulley and *h* the pedestal.

For railway central stations to run 50 cars, the allowance is generally about 11 indicated horsepower per car, and two engines should be provided, each of about 275 horsepower, and four 125 K. W. dynamos. When a road has 100 cars, three engines should be used, in order to allow the repair of one and still be able to continue the service; by reckoning 10 horsepower per car, we have a total of 1,000 horsepower. Two compound or triple expansion engines of 400 horsepower and one compound engine of 200 horsepower can here be used, the larger ones belted each to two 175 kilowatt dynamos and the smaller to one 175 kilowatt machine. In still larger installations, direct connected units are very desirable, but the power available per car should not in the largest plant be below 9 H. P.

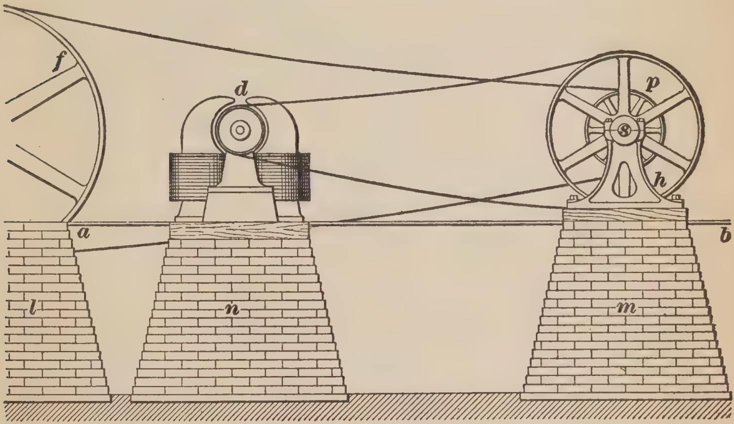


FIG. 19.

46. Switch Board Connections.—On account of the continually changing load, electric railway generators are usually

Sample Page of Instruction Paper. Subject—Dynamos and Motors.

6. The next step is to demonstrate the principle of changing, or *commuting*, this alternating current into a *continuous* current. In Fig. 17, the two ends of the coil are fastened to two halves s and s' of a metallic tube. These halves are called ***segments,*** and in this case, are separated by a small air space, the rigidity of the coil holding them apart. The combination of the two segments, or, in fact, any number of segments held together in this position is called the ***commutator.*** Two copper strips $+B$ and $-B$, called ***brushes,*** press against the segments and are held in a horizontal position while the coil is rotated. The brushes rub, or *brush*, against the segments and make electrical contact only.

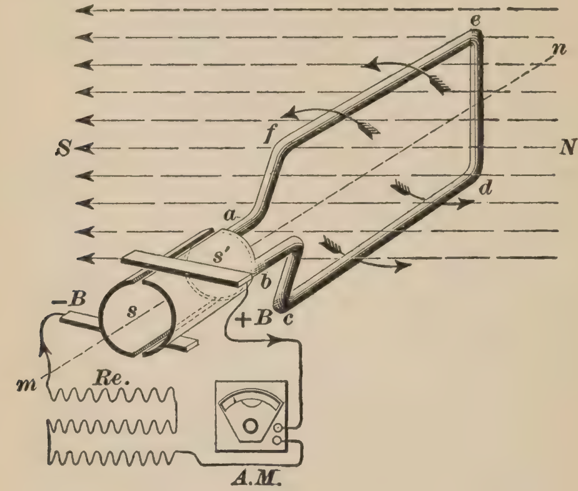


FIG. 17.

When the coil is in a vertical position, as represented in the figure, both brushes rest against both segments; but, as soon as the coil starts on the first half of a revolution in the direction indicated by the arrows, the brush $-B$ leaves segment s', and rubs only against segment s; brush $+B$ leaves segment s and rubs only against segment s'. As previously described, the

Sample Page of Instruction Paper. Subject—Electric Lighting.

THE ARC LAMP.

13. An outline of the arc lamp is shown in Fig. 3. The positive carbons are a and a_1; b and b_1 are the negative carbons; c and c_1 are carbon rods for holding the active carbons; H contains the mechanism for keeping the carbon points at a constant distance; p and p_1 are binding posts for the line wire; m and m_1 are chimneys, which give added space for the travel of c and c_1, and k is the ring for hanging the lamp. The active carbons are fastened in place by thumb-screws e, e_1, e_2 and e_3. The figure shows two sets of carbons. Only one set, however, is in operation at one time, the second coming into operation as soon as the first is burned out. Lamps which burn for about eight hours are manufactured with one set of carbons, while with two sets they will burn about sixteen hours.

Although many inventions have been made upon the apparatus for regulating the distance of the carbons, they all follow two general methods of design; namely, the rack and gear wheel, in which a long rack, moving up and down upon the end of the rod holding the positive carbon, engages with a gear wheel which imparts the motion; and the clutch in which the holding rod is held in a peculiar way by a device which is usually operated by the attraction for its armature exerted by an electro-magnet or a solenoid. The rack and gear wheel may be operated by clock-work until the carbons are at the right distance, and then stopped by the attraction for its armature of an electro-magnet through which the main current passes; or, they may be brought into action by a force of gravity and the heat produced by the main current. The clutch may be acted upon and released by the force

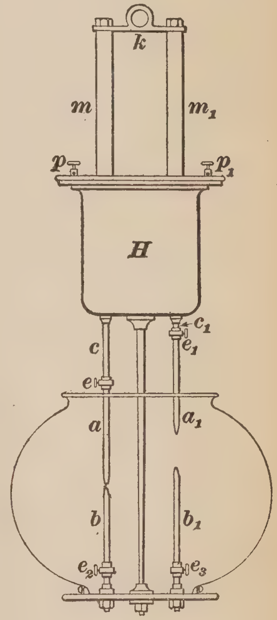


FIG. 3.

Sample Page of Instruction Paper. Subject—Electric Railways.

13. The standard overhead trolley system employs for active conductor a single copper wire m n, Fig. 8, not smaller than No. 0 Brown & Sharp gauge, and very frequently No. 00 or 000. The current passes from the positive pole of the dynamo d in the power station, along the wire to the point t where the trolley wheel makes contact. From here it flows through the pole p on the roof of the car C, or through insulated wires within it, thence to the controlling mechanism on the car platform, by means of which the speed of travel may be regulated within the limits of the motors. Interposed in the circuit through the car are lightning arresters, fusible cut-outs and switches. The motors r are placed beneath the car floor, and the current passes from them through the car axles and wheels to the rails x y, which are connected to the minus terminal of the generator and also to ground. The car is shown more in detail in Fig. 9. The controllers, c, c_1, are placed in upright iron cases on the platforms, one at each end, and are operated by the handles on the top; the shorter handles n, n_1 are reversing levers for changing the direction of travel of the car. Under the car are the motors m, m_1 in dust-proof cases; on the armature shafts are pinions a, a_1 which engage with the gearwheels b, b_1 fixed rigidly to the wheel axles. In a convenient position is the starting rheostat r, containing resistance which is put in series with the armature when starting the motors, or in some cases used partly for this purpose and partly as a shunt across the field windings for regulation of speed. Beneath the seats in the car are the heaters h on an independent circuit. For interior illumination there are usually

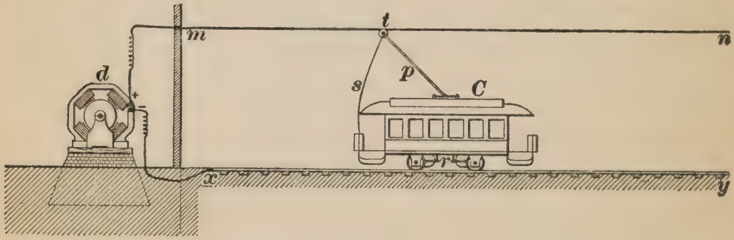


FIG. 8.

SPECIAL PRICES FOR TWO OR MORE SCHOLARSHIPS TO THE SAME PERSON.

A considerable reduction in the prices of Scholarships will be made to persons who wish to purchase more than one Scholarship at the time of enrolling. Thus, for instance, a special rate will be made on the Full Scholarship in The Correspondence School of Mines and the Complete Mechanical Scholarship of The Correspondence School of Mechanics, or on two or more of any of the Scholarships. Intending students wishing to enroll for more than one Scholarship at the same time should write, asking for prices.

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A considerable reduction in the price will be made to students already enrolled who wish to enroll in one or more additional Scholarships.

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When students wish to be transferred from one Scholarship to another of the same price, and where the work already done is all included in the Course to which they desire to be transferred, the charge for transfer will be one dollar. In all other cases a special price will be made which can be ascertained by writing to the Schools.

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When three or more persons together purchase Scholarships in The International Correspondence Schools, we will make a discount of 10 per cent. on the price of each Scholarship.

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We will send circulars and other literature to those organizing Clubs, for distribution, or if they will send us the names and addresses of probable students we will write to them and send them circulars and assist in every way possible to secure them as students.

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We have made arrangements whereby we can supply at a low price Rubber Hand Stamps, containing the Names, Addresses and Class Letters and Numbers of students. One of these stamps will be found a great convenience. By using it on the stationery the necessity of writing the full name and address, and class letter and number, in every communication sent to the Schools, is done away with. The stamp can be used for signing letters and also for putting the name and address on the upper left-hand corners of envelopes, thus avoiding all possibility of errors or delays. The stamp is made of hard rubber, neatly and firmly secured to a strong and serviceable handle. It is about 2¼″ in length and will be sent to any address, together with a self-inking pad for use in connection with the same, for 50 cents, postage paid.

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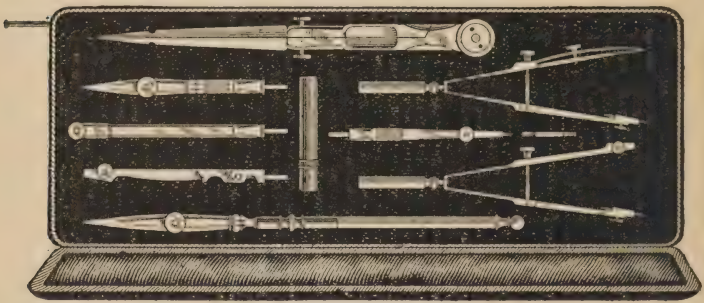

	Price.	Postage
Morocco-covered Pocket case of Fine German Silver Instruments, *Containing:* 1 Compass 5½ inches with Pen, Pencil, Needle Points and Lengthening Bar. 1 Drawing Pen, 4½ inches with Joint and Needle Point. 1 Bow Pen. 1 Bow Pencil. Pencil Case and Adjusting Key	$6.25	$0.10
One Drawing Board (Pine Wood) 16x21 inches, dovetailed. (By express only).	0.75	
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One 12-inch Boxwood Scale, 1½, 3 and 12 inches to the foot .	0.75	0.02
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Thumb Tacks, half dozen	0.25	0.02
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One ¾-oz. bottle Higgins' Drawing Ink	0.25	0.10
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Two Sheets Imperial Tracing Cloth, Demy size	0.25	0.06
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Students in the Architectural, Bridge Engineering and Railroad Engineering Scholarships require a scale containing additional graduations, and costing 75 cents more than the scale above mentioned.

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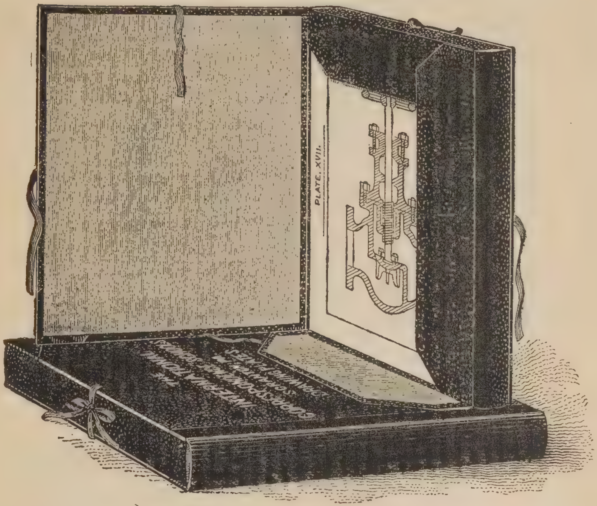
In nearly all the Courses of our Schools the student is required to draw a number of Plates and Tracings, 14″ x 18″ in size. Most students desire to preserve these Plates. The Portfolios here illustrated are made expressly for the purpose. They are of good quality, with leather backs and corners, cloth sides and flaps, and can be ordered through The Colliery Engineer Company, or will be sent by The Technical Supply Company, Scranton, Pa., to any address, postage paid, upon receipt of $2.00. By express, $1.60.



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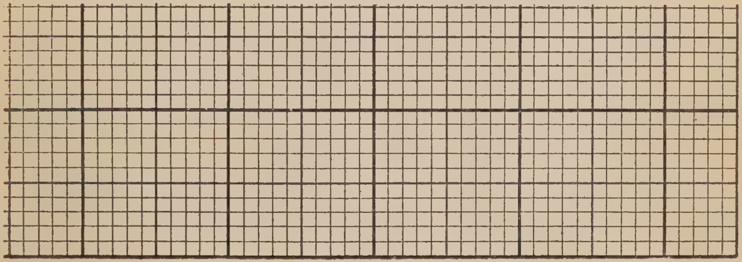

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The Instruction and Question Papers of the School constitute complete and thorough text-books on the trades of which they treat, and the student should preserve them as clean as possible for future reference. To aid in doing this Cloth Binders, 6¼″ x 9¾″ size, have been prepared and are furnished by The Technical Supply Company, Scranton, Pa. The Binders can be ordered through The Colliery Engineer Company. Price, per set, $1.00; postage paid, $1.18. When ordering Binders please state the Course or Scholarship for which you wish them.

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Good light linen paper, 13 x 8½ inches, for the use of the students in writing their answers to Question Papers. This paper will largely reduce the student's postage bill. It can be ordered through The Colliery Engineer Company.

100	**sheets by mail (postage paid)**	**$0.45**
250	**“ “ “ “**	**1.15**
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